ELECTRICAL REVIEW

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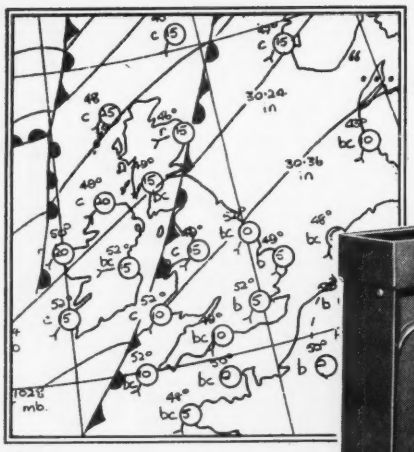

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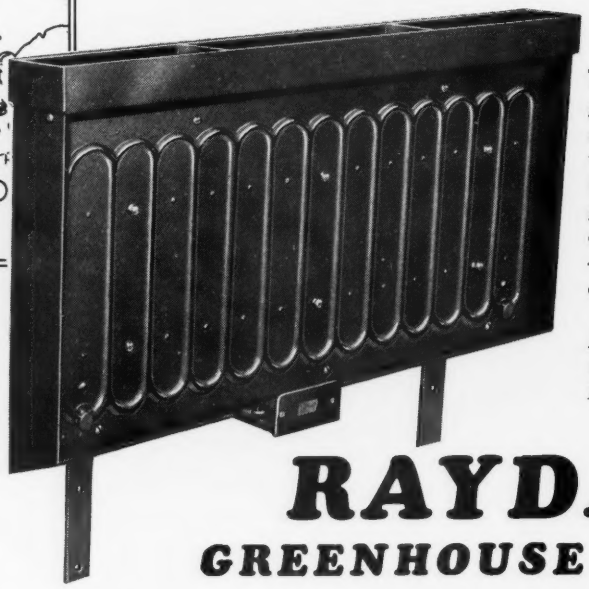

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ELECTRICAL REVIEW

9 July 1954 Vol. 155 No. 2 Established 1872

Oil Circuit Breaker Arc Control

FOR about 50 years oil circuit breakers have been the accepted means of controlling high voltage electrical circuits. The first types in service generally comprised a simple arrangement of contacts immersed in a large mass of oil which relied upon random oil turbulence for arc extinction. The performance was often erratic, but facilities for studying the factors influencing the behaviour of an arc were very limited. The E.R.A. was one of the first organizations to study the problem on a scientific basis and reports which it has issued since 1922 have been a valuable aid to manufacturers.

The greatest commercial progress was made, however, when the high power testing stations came into being, providing designers with means for studying the performance of circuit breakers over a wide range of currents and voltages. The need for some method of localizing and controlling the arc, in the vicinity of the contacts, was realized and arc control devices were developed. Various types of device are now available and much information has been published on this subject. Considerable improvements have been made in the performance of circuit breakers particularly by confining the high pressures created by fault interruption to the arc control device itself. This has resulted in simplification of the design of tanks and top plates and a very considerable reduction in the arcing times. This reduction applies throughout the range of fault currents and has eliminated the tendency to failure which was sometimes experienced at small values of breaking current. It is now well established practice to apply some form of arc control to circuit breakers for operation at voltages above 3.3 kV.

Supply systems have continued to grow rapidly and there has been a continuous demand for circuit breakers with ever increasing breaking capacities. Although the performance of most types of arc control device tends to improve with increase in current interrupted, a limit must be reached, which depends upon the physical strength of the structure and mechanism to withstand the pressures developed. As is pointed out by Messrs. W. A. McNeill and P. H. G. Crane in an article which appears in this issue, it is of great importance to be able to predict the pressures which may be set up in an enclosure by the release of arc energy, and thereby to ensure that maximum performance is obtained from a given frame size of equipment and also to reduce the number of short-circuit tests which will be required to determine the limiting performance. This is of considerable economic interest in view of the fact that the expensive nature of high power testing is one of the factors seriously influencing the cost of switchgear.

WHY PURCHASE TAX?

When the purchase tax was instituted in 1940 the Government of the day intended it to be a wartime measure designed to check public expenditure, and the rates of tax were graded according to the degree of non-essentiality. Goods subjected to the higher rates were regarded as luxuries; those bearing lower tax were necessary but had to be " rationed " in some way. There may still be a need to curtail public expenditure to some degree to ensure sufficient labour and material for exports but the necessity is a rapidly-diminishing one. Generally speaking production appears to be sufficient both to satisfy the home market and export trade. Continuance of purchase tax on goods which are already expensive enough merely maintains the cost of living at a high level and helps to produce further wage demands. Unfortunately the original reason for purchase tax is being forgotten. The tax has become a fruitful source of revenue. That (and not restriction) was why the Chancellor of the Exchequer last week declined to consider a reduction in the rates, proposed by Mr. Douglas Jay. He mentioned that the annual revenue from the tax was £300 million; the concessions would have cost £55 million. The prospect of any further substantial relief in this direction therefore seems fairly dim.

LATIN-AMERICAN OPPORTUNITIES

It has long been apparent that we are not doing as much business with some of the Latin-American countries as we could. With a view to remedying this Sir George Nelson recently undertook an extensive tour with the blessing of the Government and the Federation of British Industries and some of his conclusions are referred to in this issue. Sir George has come back with a very optimistic report. He found that there was a favourable attitude towards this country although this was coupled with an imperfect understanding of what we had gone through and of our struggle to get back to our pre-war position. The countries which he visited possess vast undeveloped resources and he feels that British capital and industry can do much to open these up for the benefit of the countries themselves and world economy in general. Indeed he reports that during his visit he had many conversations which are likely to lead to definite plans for development in which British industry will participate.

INSPECTION AND REGISTRATION

Safety and soundness, together with adequacy and convenience, are the attributes of a good electrical installation. A member of the public can judge for himself whether he is getting an adequate and convenient installation but he needs guidance (and indeed protection) in respect of the other points. Up to now there have been two ways in which he could obtain this—by giving his work to a member of the Electrical Contractors' Association (which has a guarantee arrangement) or to a contractor on the National Register of Electrical Installation Contractors. But much installation work is carried out by the Electricity Boards and on the face of things these, too, should provide satisfactory installations. Moreover there may be reliable contractors who are neither registered nor in the E.C.A. There thus seems to be a need for a single body which could keep an eye on installation work generally and bestow its *cachet* upon the " good " contractor. An attempt to set up such a body has now been proceeding for five years and the history of the subject is covered in an article in this issue. Whether the attempt will succeed seems to depend upon the final decision of the E.C.A. which is still awaited. The scheme could be launched without the participation of the E.C.A., but this would not be satisfactory. The Association apparently wishes to couple with it the compulsory registration of contractors and operatives but the chance of this coming about seems remote. Maybe the setting-up of a National Inspection Council would be a first step towards compulsion if experience showed that without it the Council could not ensure safe and sound installation work.

NATIONAL REGISTER

Reference is made in the foregoing leaderette to the National Register of Electrical Installation Contractors. This body published its annual report last week (*Electrical Review*, 2nd July, page 19) from which it could be seen that the number of registered contractors diminished still further during 1953, reaching 879. At one time there were over 1,700 on the Register, but the withdrawal of the support of the Electrical Contractors' Association in 1946 naturally had a serious effect upon numbers. Originally the Register had the backing of the Incorporated Municipal Electrical Association and when that body disappeared under nationalization its support was continued by the British Electricity Authority. It is believed that the B.E.A. saw in it the nucleus of a wider scheme—and still may. In the meantime, as we said in our leading article of 4th June, the Register is continuing its activities in a subdued manner, waiting for something to happen.

WHAT'S IN A NAME?

At the recent British Electrical Power Convention at Eastbourne we frequently heard it remarked that the method of showing against the names in the list of delegates merely their associations was not very helpful. As only organizations—not individual concerns — are represented at the Convention this practice may be strictly correct but it would be much more useful to those attending the Convention to know from which companies the manufacturers', contractors' and other representatives came. It might also be possible to indicate the actual localities of Electricity Boards' representatives. We realize that to provide this information involves a little more trouble and space in the compiling of the list but the labour would by no means be wasted and the organizers would earn the gratitude of delegates for this extra service.

ARC CONTROL DEVICES

Performance in Single Break Oil Circuit Breakers

By W. A. McNEILL, B.Sc.Tech., M.I.E.E., M.Am.I.E.E. and P. H. G. CRANE, M.Sc.*

THE results of work carried out by the British Electrical and Allied Industries Research Association have provided a sound foundation for the calculation of pressures in arc control devices, particularly with reference to the side-blast baffle. The nature of the problem is such that several sweeping assumptions must be made in applying the formula to a particular form of arc control device. The facilities available to the E.R.A. have also limited verification to relatively small values of power.

The object of this article, which is being published in two parts, is to present additional short-circuit test data that have been obtained on a commercial design of circuit breaker at high values of short-circuit current and to compare the calculated and measured values of pressure in the interrupting device. Illustrations are given of the effect on maximum pressure of a number of factors which may vary in service and examples are included of the applications of the pressure calculations to a typical series of circuit breaker ratings. The data presented will not be equally applicable to all types of oil circuit breakers, but a wider application of the E.R.A. work could usefully supplement the empirical methods of design which have been mainly relied on hitherto, and it is hoped that other authorities will also make available confirmatory data.

Gas Pressure Formulæ

The formulæ for gas pressure derived by the E.R.A. and contained in their Technical Report G/XT72 † apply primarily to conditions in the E.R.A. side-blast baffle. The side-blast baffle is in effect simply an enclosure, of such length as to enclose all normal lengths of arc, provided with a side vent. Its general dimensions are such that appreciable gas pressures are set up owing to the baffling of the escaping gas, and the formula is derived accordingly. A number of arc control devices exist which are similar to the side-blast baffle in general principle but may embody minor refinements of design, and cases may exist when the E.R.A. formula is not applicable to all stages of arcing. For example, where a complex arrangement of passages exists the gas pressure developed may be due to the restriction of oil flow from the device during the greater part of arcing, the free efflux of gas occurring late, or even after extinction.

The fundamental principle from which the E.R.A. pressure formula is derived is that the rate of rise of pressure within the baffle is given by the excess of the rate of formation of gas from the oil over the amount of gas forced out through the side vent and/or any other outlets.

Stated symbolically: $$\frac{dp}{dt} = \frac{ei.\,Vg.\,T.}{273\,V_1} - \frac{p.\,A.\,Vt}{V_1} \quad \ldots\ldots(1)$$

where p is pressure, in atmospheres; ei is total instantaneous arc power; Vg is rate of gas generation per unit of total arc energy, referred to n.t.p.; T is the mean temperature of the gas bubble; V_1 is the mean volume of the gas bubble; A is the effective outlet area; Vt is the velocity of outflow of gas through the outlet.

In order that equation (1) may be readily solved, the various factors must be reduced to functions of pressure or time, or must be treated as constants. Thus, current is assumed to be purely sinusoidal, and the arc voltage gradient is treated as a function of pressure $e_1 = K\sqrt{p}$ . . (2) where e_1 is arc voltage gradient and K is a constant.

Expression (2) has been deduced by the E.R.A. from extensive experimental investigation and will be discussed later in the light of further test results.

The exact solution (3) to equation (1) is somewhat cumbersome and a shorter approximate solution (4) is given in the report and appears to be adequate for the types of cross jet pot to be considered. Generally, the exact solution is necessary in cases where the ratio of gas outlet area to mean gas bubble volume is relatively very small.

Exact Solution:

$$p^1 = \frac{1}{\omega^2 + c^2} \times \left[\sin \omega t \left\{ c(a + bt) - b + \frac{2b\omega^2}{\omega^2 + c^2} \right\} + \cos \omega t \left\{ \frac{2bc\omega}{\omega^2 + c^2} - \omega(a + bt) \right\} + e^{-ct} \left\{ \omega a - \frac{2bc\omega}{\omega^2 + c^2} + \omega^2 + c^2 \right\} \right] \quad \ldots\ldots\ldots(3)$$

Approximate solution:

$$p^1 = \frac{1}{\omega^2 + c^2} \left[\sin \omega t \left\{ c(a + bt) - b \right\} - \cos \omega t \left\{ \omega(a + bt) - \frac{2bc\omega}{\omega^2 + c^2} \right\} \right] \quad \ldots\ldots\ldots\ldots(4)$$

where $a = \frac{1}{2} \frac{\text{lo. k. im. Vg. T.}10^{-3}}{273\,V_1}$, $b = a\,\frac{Vm}{lo}$, $c = \frac{1}{2}\,\frac{A.^1 Vt}{V_1}$

and lo is the arc length at the beginning of the loop under consideration, im is the peak current in the loop and Vm is the velocity of the moving contact.

Application of the E.R.A. Formula

Much of the experimental work of the E.R.A. has been devoted to the determination of suitable values for the "constants," Vg. T. Vt. and k, and the quantities used may be subject to revision as additional data become available. For the purpose of the present investigation, the following values have been used: Vg=100 cm³ per kW sec of arc energy, referred to n.t.p.; T=2,000 deg A; Vt=10^5 cm/sec and k=50.

Arc length is assumed to be a function of time only and, according to the type of breaker and arc control device, some allowance may have to be made for magnetic blow-out effects upon arc length.

The factor V_1, the mean gas bubble volume, is fortunately not very critical in the build-up of pressure, since in many applications its estimation is by no means simple. The capacity of the E.R.A. baffle was only 87 cm³ and V_1 was justifiably given this value in their calculations. Many interrupters, associated with higher ratings, have very much greater capacity and the gas bubble mean volume in such cases may be appreciably less than this capacity, depending upon the order of fault power involved. No allowance is made for the possible effect of gas cushion in

* The authors are with Cooke & Ferguson, Ltd.

† "The Calculation of the Pressure Set up Inside the Cavity of an E.R.A. Side-Blast Baffle Circuit Breaker," by C. E. R. Bruce, M.A., B.Sc.

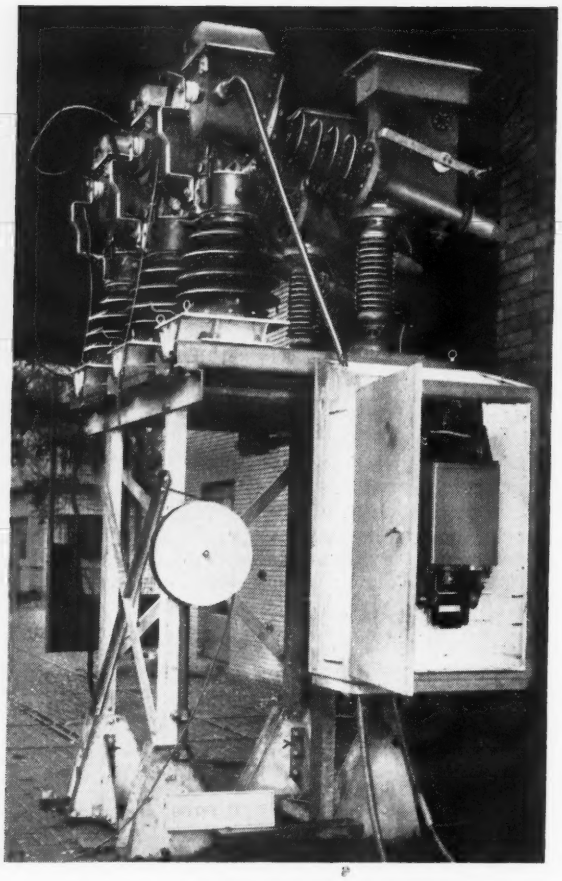
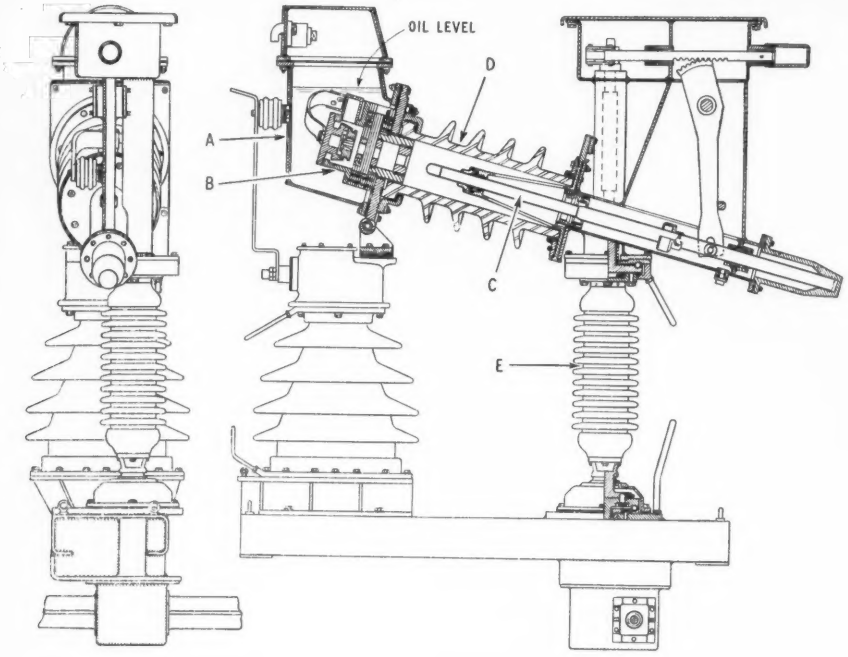


Fig. 1.—Three-phase circuit breaker set up for testing

Fig. 2.—Cross section of one phase unit of a three-phase circuit breaker



the cross jet pot. Some commercial designs of oil circuit breakers incorporate such features for the purpose of limiting peak pressures but little data has been available to verify the effectiveness of the cushion.

The application of the E.R.A. formula to a case of asymmetrical current may be made without loss of accuracy only where the mathematical expression appropriate to the displaced current wave is known. Such an expression may be substituted for the sinusoidal symmetrical term in the differential equation developed from (1) which may then be solved and the modified formula used.

A suitable asymmetrical expression, based upon the breaker short-circuit rating, may be formulated when estimating pressures at the design stage, but methods of calculation based upon data available from oscillograms must of necessity be more approximate. By means of careful measurements the equivalent values of "im" (current at peak) and "ω" ($2\pi \times$ frequency) may be obtained for each loop of the asymmetrical wave, and the "symmetrical" formula used. In view of the necessarily approximate nature of the calculations generally, it is considered that this latter procedure is justified.

To apply the foregoing equations in practical design, certain basic assumptions must be made regarding the dimensions of the arc control device and other parameters affecting its operation. The problem of co-relating the many factors involved is complex and to obtain corroborative data, a series of short-circuit tests were carried out over a wide range of currents, and the pressures generated in the arc control device were measured.

The circuit breaker selected was of the live tank, low oil content single break type, rated at 1,000 MVA symmetrical at 33 kV. The particular design was selected since it permitted easy access to the arc control device, thus facilitating the fitting of a pressure-sensitive element and also permitting modifications to be carried out with a minimum of delay. Fig. 1 shows a three-phase breaker set up for tests and Fig. 2 a cross section of one phase unit of a three-phase breaker. The steel tank A houses the arc control device B, and the moving contact rod C operates in a porcelain tube D and is driven by a rotating torsion porcelain E through linkage contained in the steel housing mounted on top of the torsion porcelain. Removing the cover from the tank A and draining off a small quantity of oil, gives easy access to the arc control device; in many cases draining off to make only minor adjustments was unnecessary. Fig. 3 shows the pressure-sensitive element fitted to this arc control device.

The tests were carried out at the KEMA Short Circuit Laboratory in Arnhem, Holland (see *Electrical Review*, 9th June, 1950), where facilities are available for three-phase short-circuit tests at full recovery voltage up to 1,200 MVA symmetrical at 33 kV.

To co-ordinate the magnitude and characteristics of the pressure wave with the current, arc voltage, arc length and other relevant factors, an oscillographic record of this

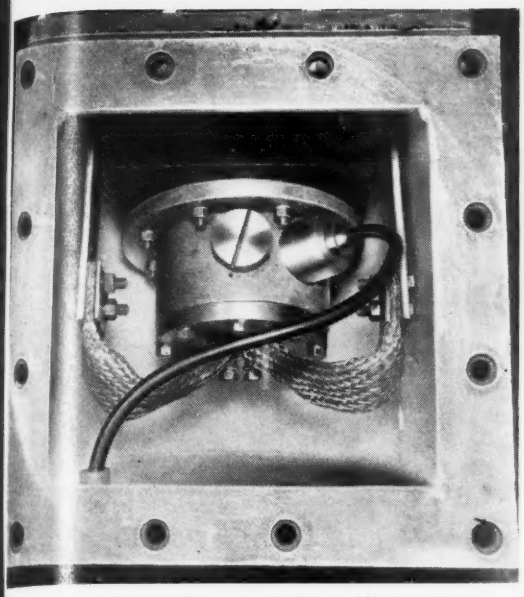


Fig. 3.—The pressure-sensitive element fitted to the arc control device

pressure suitably co-related to the other quantities was obtained by apparatus designed and constructed by KEMA as indicated schematically in Fig. 4. The circuit consists basically of a bridge network having the pressure-sensitive element connected in one arm and supplied from a 10 kc/s source. The pressure-sensitive element (Fig. 3) consists essentially of an iron cored inductance, having in its iron circuit an air gap which is varied by the movement of a diaphragm caused by the pressure in the arc control device.

The bridge is balanced at atmospheric pressure and any increase in the pressure acting upon the diaphragm will alter its inductance and thus unbalance the bridge. The out of balance voltage is fed into an amplifier through an

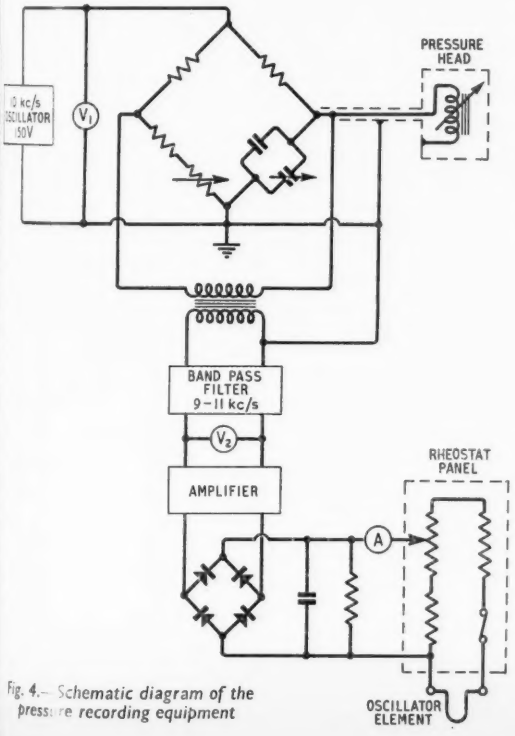


Fig. 4.— Schematic diagram of the pressure recording equipment

TABLE I.—SUMMARY OF SHORT-CIRCUIT TEST RESULTS

TEST NO.	BREAKING CURRENT: Average r.m.s. kA	BREAKING CURRENT: B-Ph. r.m.s. kA	Recovery volts line kV	Arc duration sec × 10⁻² (B-Ph.)	Maximum pressure in control device lb/sq in	REMARKS
(a) Tests on type OE6 33 kV live tank outdoor oil circuit breaker						
521110-05	1·24	1·20	32·4	2·9	*	5 per cent air cushion
521110-06	1·23	1·19	32·1	4·4	*	Top vents open
521110-07	1·23	1·20	31·9	3·5	*	Easy performance
521110-08	1·24	1·20	32·2	3·4	*	5 per cent air cushion
521110-09	1·27	1·23	32·6	2·9	*	Top vents closed
521110-10	1·25	1·21	32·7	3·0	*	Easy performance
521110-11	1·25	1·20	32·2	3·0	*	No air cushion
521110-12	1·25	1·20	32·6	2·9	*	Top vents closed
521110-13	1·24	1·21	32·2	2·5	*	Easy performance
521110-14	1·25	1·23	32·0	3·2	*	No air cushion
521110-15	1·25	1·23	32·2	4·2	*	Top vents open
521110-16	1·26	1·24	32·2	3·1	*	Easy performance
530316-07	1·29	1·30	32·7	3·5	57	No air cushion
530316-09	1·28	1·29	31·7	4·1	93	Top vents open
530316-10	1·29	1·30	31·7	3·2	55	Easy performance
530316-11	1·34	1·37	32·4	3·8	78	No air cushion
530316-12	1·35	1·40	31·9	3·2	78	Top vents closed
530316-13	1·38	1·41	33·1	2·8	77	Easy performance
521110-17	2·71	2·70	33·6	3·0	70	No air cushion
521110-18	2·68	2·68	33·2	2·3	100	Top vents open
521110-19	2·67	2·65	33·0	3·1	130	Easy performance
521110-21	2·72	2·71	33·1	2·9	100	5 per cent air cushion
521110-22	2·73	2·73	33·2	2·9	90	Top vents open
521110-23	2·73	2·73	33·1	4·2	120	Easy performance
530316-14	2·72	2·72	33·1	2·3	203	No air cushion
530316-15	2·75	2·75	32·9	3·5	101	Top vents open Easy performance
530316-16	2·76	2·80	33·3	2·9	102	No air cushion
530316-17	2·75	2·74	32·1	3·3	100	Top vents open
530316-18	2·78	2·74	32·2	2·8	115	Easy performance
521110-24	4·51	4·51	33·4	2·0	70	5 per cent air cushion
521110-25	4·60	4·60	33·4	2·3	100	Top vents open
521110-26	4·55	4·55	33·1	2·4	*	Easy performance
521110-27	4·53	4·48	33·6	2·8	180	No air cushion
521110-28	4·54	4·50	33·2	2·4	170	Top vents open
521110-29	4·54	4·62	33·2	2·2	160	Easy performance
530316-19	4·63	4·60	32·1	2·9	240	No air cushion
530316-20	4·61	4·50	32·1	2·4	215	Top vents open
530316-21	4·66	4·62	31·9	2·2	135	Easy performance
521110-30	9·06	9·05	33·2	2·5	340	No air cushion
521110-31	9·02	8·95	33·0	2·6	290	Top vents open
521110-32	9·05	8·98	32·7	2·8	260	Easy performance
521111-01	9·19	9·12	34·3	3·1	260	5 per cent air cushion
521111-02	9·26	9·14	34·1	2·3	240	Top vents open
521111-03	9·41	9·05	34·6	3·0	300	Easy performance
521111-04	13·7	13·4	34·1	2·5	275	5 per cent air cushion
521111-05	13·7	13·2	34·1	3·2	*	Top vents open
521111-06	13·7	13·4	33·8	2·4	*	Easy performance
521111-31	13·3	13·4	33·5	3·2	600	No air cushion
521111-32	13·5	13·8	33·6	3·3	600	Top vents open
521111-33	13·3	13·6	33·1	2·8	580	Easy performance
530316-23	13·5	13·4	31·3	2·4	505	No air cushion
530316-24	13·8	13·7	32·5	2·8	470	Top vents open
530316-25	13·9	13·7	32·5	2·7	570	Easy performance
521111-34	14·1	16·4†	34·2	1·7	170	No air cushion
521111-35	14·2	15·7†	33·4	1·8	280	Top vents open
521111-36	14·2	16·8†	34·1	1·7	185	Easy performance
521112-18	17·1	17·3	30·6	2·4	600	No air cushion
521112-19	17·1	17·3	30·5	2·0	600	Top vents open
521112-20	17·1	17·3	31·0	2·3	600	Easy performance
521112-21	19·0	19·3†	31·0	2·4	235	No air cushion
521112-22	19·2	27·8†	31·2	1·7	316	Top vents open
521112-23	18·0	17·8†	32·2	1·5	185	Easy performance
(b) Tests on type OF1 66 kV dead tank outdoor oil circuit breaker (pressure measurements and data refer to Y-phase)						
530924-06	13·8	13·6	21·6	2·4	440	No air cushion
530924-07	13·6	13·4	21·5	2·0	350	No top vents
530924-08	13·7	13·8	21·5	2·2	420	Easy Performance
530924-14	13·2	13·1	21·1	2·4	250	
530924-15	13·2	13·1	21·1	1·9	200	
(c) Tests on type OE5 33 kV dead tank outdoor oil circuit breaker (pressure measurements and data refer to R-phase)						
(i) Normal break operations						
540212-15	11·1	10·9	34·7	1·8	185	5 per cent air cushion
540212-16	11·1	10·9	34·8	1·6	175	No top vents
540212-17	10·8	10·9	34·9	2·0	135	Easy performance
540212-18	8·15	8·0	24·9	2·0	107	
540212-21	17·1	16·0†	26·5	2·0	475	
540212-22	17·7	20·1†	26·9	1·8	175	
540212-23	18·2	22·8†	27·1	1·2	340	
(ii High speed reclosing operations						
540218-16	13·8	13·8	29·6	1·6	515	Pre-"contact-make"
2nd break	13·2	13·2	32·4	1·7	360	pressure: 190 lb/sq in
540218-17	17·2	17·3	26·3	2·3	620	
540218-18	16·5	16·5	25·7	1·6	1090	Pre-" contact-make"
2nd break	15·0	14·7	26·7	3·1	300	pressure: 95 lb/sq in
540218-19	15·7	15·6	24·1	2·1	445	Pre-" contact-make"
2nd break	14·8	14·8	26·1	2·4	270	pressure: 130 lb/sq in

NOTE: *Pressure recorder inoperative or unreliable. †Asymmetrical current.

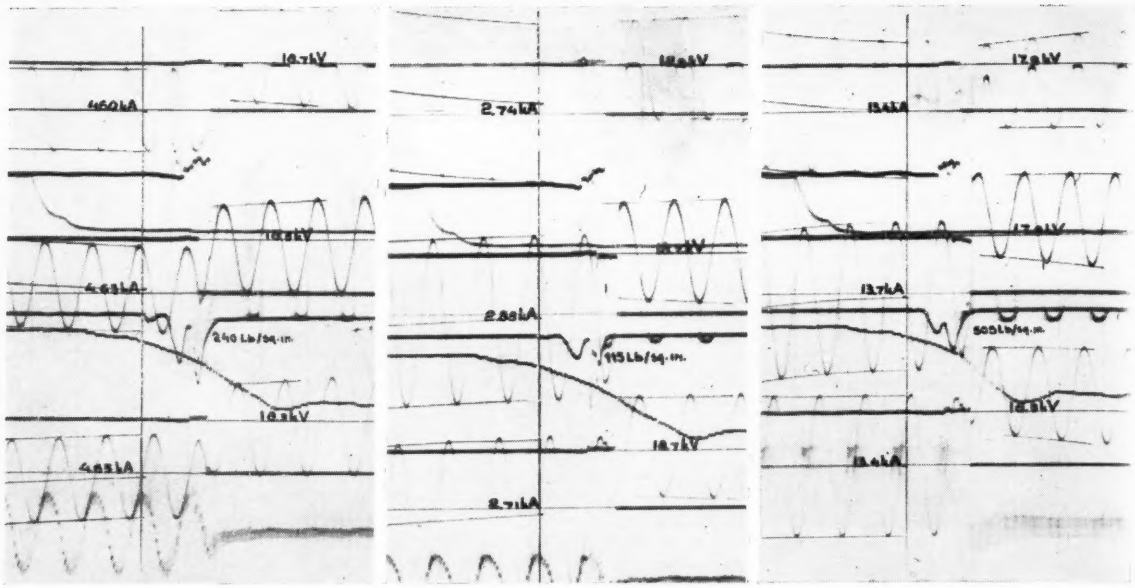


Fig. 5.—Typical oscillograms taken during the tests

impedance matching transformer and filter having a pass band of 9–11 kc/s, the latter eliminating any 50 c/s pick-up provided it is connected to the same earth point as the bridge circuit. The transformer also isolates the bridge circuit from the recording apparatus. The output from the amplifier is rectified and the resulting unidirectional current is applied to one element of a 12 element electromagnetic oscillograph on which the phase voltages and currents are also recorded.

In some of the earlier tests the pressure waveform had a tail which persisted for some time after final arc extinction. The area available for the release of pressure suggested that the pressure should have fallen much more rapidly after arc extinction than was shown by the oscillograms. This was found to be due to the long time-constant produced by a large capacitor which was connected across the output of the rectifier and on reducing the value of this capacitor the response was considerably improved.

Some difficulty was also experienced on some of the earlier tests because of the non-linear characteristic of the rectifier; the response was improved by biasing the rectifier to bring the operating point on to the linear portion of the characteristic. In its final form, the equipment gave a practically linear response over the range of pressure from 15 to 1,000 lb/sq in with an accuracy of ± 5 per cent.

Test Programme and Results

Results of tests carried out on the live tank breaker, for a range of currents from 1·5 kA to 17·5 kA symmetrical and up to 28 kA asymmetrical at 33 kV recovery voltage are given in Table 1 and typical oscillograms are shown in Fig. 5. During the tests the leakage area of the arc control device was varied by opening or plugging release holes in its body. The tests were conducted with and without an air cushion to determine its effect on the pressure generated and indirectly on the performance of the device. The cushion was 5 per cent of the volume of the arc control device and the no-load contact speed of the circuit breaker was unaltered throughout the tests.

The cross jet pot pressure was recorded on the blue phase of the circuit breaker and the maximum values evaluated for each test are tabulated in Table 2. Additional tests were carried out on two outdoor dead-tank conventional oil circuit breakers rated at 66 kV and 33 kV respectively, and the relevant data have been included in Tables 1 and 2, Sections (b) and (c). The 33 kV tests included a number of reclosing duties. These additional tests will be discussed later.

The pressures for the tests were also calculated according to the method previously described using values of arc length, contact velocity and final loop peak current taken from the oscillogram records. Typical values obtained are given in Table 2 for comparison with the recorded pressures. The data in Table 2 is recorded in ascending order of final loop r.m.s. current.

The final loop r.m.s. currents differed occasionally from the average r.m.s. current at contact separation owing to circuit conditions. The most noticeable features of these results are, first, the broad agreement between calculated and recorded values at currents above about 6 kA r.m.s. and secondly, the marked discrepancies existing below this current value. It is, of course, at the maximum rated current, that it is important to be able to calculate the pressure accurately.

Over the lower range of currents the calculated pressures average about one-third of the actual values, and this order of discrepancy, having regard to the otherwise comparatively close agreement, seems unlikely to be the result of drastic changes in the temperature, rate of generation, or velocity of emission of the gas. Since the temperature and rate of gas generation both tend to fall with current decrease, calculated results tend to be on the high side. On the other hand, the gas emission velocity falls off as the temperature is reduced and this would tend to offset the effect upon pressure of the variations in mean temperature and rate of gas generation.

The resultant effect of decrease of current upon pressure is difficult to assess in respect of the changes in T, Vg and Vt, but since such changes do not each act in a common direction, another factor may be largely responsible for the discrepancies.

Any factor which is important in the pressure rise, and which, although treated as a constant in the formula, may in

fact tend to vary inversely with the current would account for the discrepancies. The term " k " in the expression $e_r = k\sqrt{p}$ is an obvious suspect. The value k = 50 was adopted in all the calculations, although a possible variation with current was suspected after some of the early tests, and an amplified arc voltage trace was therefore included in the oscillogram records of subsequent tests. A study of these records would appear to indicate a tendency for " k " to vary with current and for its value over the lower part of the current range to be certainly rather higher than 50. Sufficient data is not, however, yet available to justify the formation of a definite conclusion. Furthermore, the possibility of the discrepancies being due to some inaccuracy in the pressure recorder cannot be entirely ruled out.

The assumptions were made that the effective volume, V_r, was equal to one-half of the actual cross jet pot capacity and that the effective area of an outlet was equal to 0·6 times its physical area. Probably similar methods of calculation can be applied to a wide range of circuit breakers, but it is emphasized that the formula should not be applied indiscriminately to all types and sizes of arc control devices without first considering what " effective " values should be adopted for certain factors.

Cross Jet Pot Action

The results of the tests and in particular a study of the pressure traces show the general action of cross jet pots. The example used was provided with two top vents in the fixed contact housing in addition to the main side vent; the calculations, however, took no account of the top vents on the assumption that only the side vent was effective as an outlet.

The satisfactory nature of the calculated results suggest that such top vents, owing to their remoteness from the arc, are not generally effective as gas outlets. It must be borne in mind, nevertheless, that a relatively heavy current arc may give rise to conditions in which the top vents become gas outlets at a later stage in arcing, or that they may be so arranged as to communicate more directly with the arc zone. Similarly top vents may become more effective in smaller interrupters. For the value of air cushion used in the tests, no appreciable influence on the performance of the interrupter could be detected. The effectiveness of such a device must, however, relate to the size of cushion that can be accommodated in a particular design of circuit breaker.

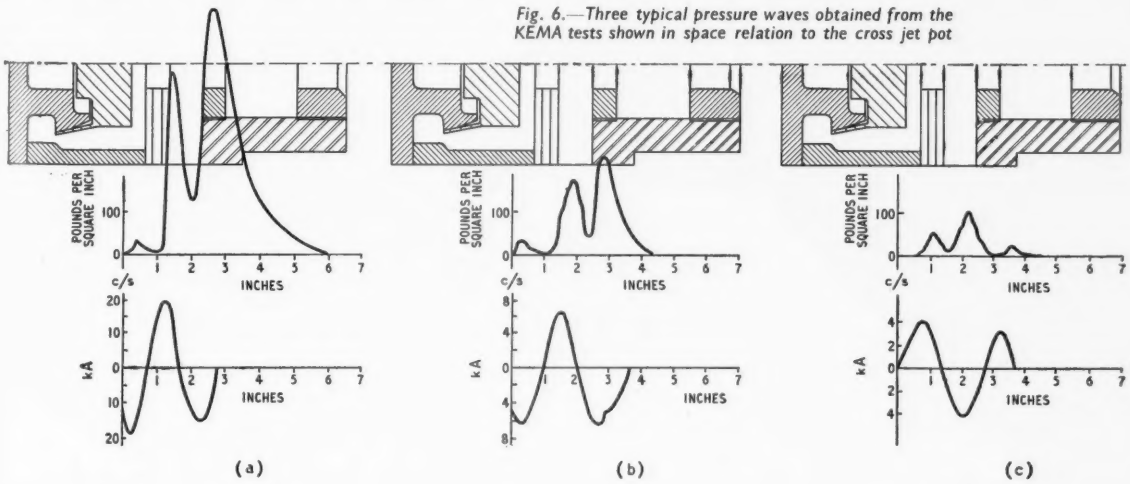
Fig. 6 shows three typical pressure waves obtained from the KEMA tests; the waves are shown in space relation to the cross jet pot, and the corresponding current waves are shown. The shapes of the traces are, therefore, not necessarily the same as on the oscillograms having a time base.

In Case (a) the current at contact separation was 13·7 kA r.m.s. and the resultant pressure wave resembles very closely in general shape and phase disposition a typical calculated wave. A feature of this wave is the very small short-lived pressure rise almost immediately after contact

TABLE 2.—TABLE OF CALCULATED AND RECORDED MAXIMUM PRESSURES

R.m.s. current in final loop kA	Test No.	Pressure (lb/sq in) Recorded value	Calculated value
(a) Tests on type OE6 33 kV live tank outdoor oil circuit breaker			
1·29	530316-07	57	20
1·29	530316-09	93	20
1·29	530316-10	55	17
1·34	530316-11	78	22
1·38	530316-13	77	15
2·13	521110-23	120	46
2·72	530316-14	205	20
2·75	530316-15	101	70
2·75	530316-17	100	30
2·76	530316-16	102	70
2·76	530316-18	115	45
4·53	521110-27	180	56
4·54	521110-28	170	53
4·54	521110-29	160	43
4·6	521110-25	100	41
4·61	530316-20	215	60
4·62	530316-21	135	50
4·63	530316-19	240	110
5·7	521111-35	218	165
7·5	521110-32	260	158
7·52	521111-03	300	175
7·6	521111-01	260	325
9·06	521110-30	340	280
9·26	521111-02	240	180
11·85	521111-32	600	590
12·5	521111-31	600	560
13·3	521111-33	580	590
13·4	530316-23	505	530
13·7	530316-25	570	630
13·8	530316-24	470	500
14·85	521112-20	600	465
9·3	521111-36	185	140
19·0	521112-21	235	195
(b) Tests on type OF1 66 kV dead tank outdoor oil circuit breaker			
17·2	530924-06	440	480
17·9	530924-07	350	200
13·6	530924-08	420	480
13·2	530924-14	250	290
13·1	530924-15	200	120
(c) Tests on type OE5 33 kV dead tank outdoor oil circuit breaker			
(i) Normal break operations			
9·4	540212-15	185	160
9·25	540212-16	175	180
9·6	540212-17	135	160
7·35	540212-18	107	170
13·1	540212-21	475	530
22·0	540212-22	175	230
23·2	540212-23	340	290
(ii) High speed reclosing operations			
11·0	540218-16	515	675
12·8	2nd break	360	360
18·3	540218-17	620	670
19·2	540218-18	1090	1150
16·0	2nd break	300	630
19·8	540218-19	445	510
13·2	2nd break	270	330

Fig. 6.—Three typical pressure waves obtained from the KEMA tests shown in space relation to the cross jet pot



separation, and this may well be due to the presence of oil momentarily preventing the free emission of gas from the side vent. A similar momentary pressure rise is very distinct in Case (b) and it seems likely that these early pressure rises exist only when contact separation occurs at a fairly high instantaneous value of current. The extent and importance of such phenomena depend to a large extent upon the design of the control device concerned.

The pressure wave of Case (b) corresponding to 4·63 kA r.m.s. is somewhat less smooth than that of (a), and (c) at 2·76 kA r.m.s. is similarly unsteady suggesting a lessening of the control over the arc.

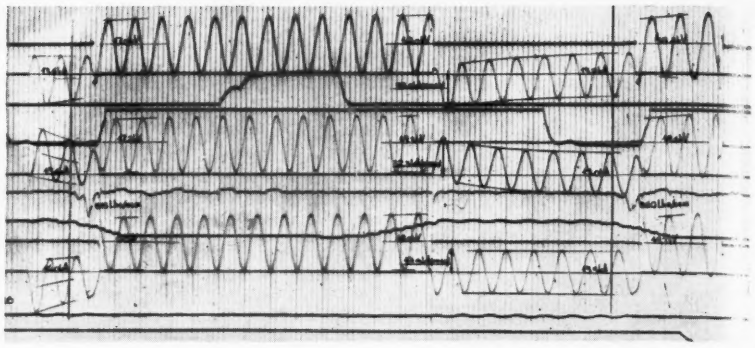


Fig. 7.—This shows the maximum peak of pressure occurring before the final current loop

The particularly interesting feature of Case (c) is the fact that the final loop pressure is much less than that of the previous loop in spite of the increasing arc length. The most likely explanation of this phenomenon would appear to be that arcing continued long enough for the top vents and possibly the clearance between the moving contact and pot throat to become effective as gas outlets.

Another feature common to a number of the pressure waves obtained and to some extent discernible in (c) is the sudden reduction of pressure coincident with the opening of the side vent.

With the design of cross jet pot employed in the tests the gas pressures developed in the early stages of arcing are generally small. This point is of interest in relation to the work of Malevinskii and contradicts the basic assumption on which some of his work is founded.*

In Table 2 are listed the recorded and calculated peak pressures relating to the type OF1 66 kV breaker and the type OE5 33 kV breaker and a good degree of agreement between the two sets of values will be observed. In several cases where final extinction occurred very soon after contact separation, particular care was necessary in estimating the effective venting area, owing to the partial restriction of the side-vent by the moving contact. Also in certain cases the maximum peak of pressure occurred before the final current loop; such an instance is the first break in Test No. 540218–19 (see Fig. 7). Here the maximum pressure is clearly due to first current loop (red-phase) which is distinctly asymmetrical and also at the corresponding stage of opening the side-vent was considerably restricted. The second, and final, current loop was small and occurred after the side-vent was almost entirely clear; these two factors more than offset the increased arc length associated with this loop of current.

A number of reclosing duties were included in the OE5 tests; the " dead time " in each case was of the order of 0·25 sec. No attempt was made to ensure rapid refilling of the arc control device before the second interruption. It was believed, therefore, that some noticeable discrepancy might exist between the recorded and calculated pressures relating to the second break operation, since a reduction in the amount of oil available for gasification at the final break would be a reasonable expectation.

From the values given in Table 2 it is clear that no such major discrepancy exists with regard to tests No. 540218–16 and 19. In the case of test No. 540218–18, however, the calculated value for the second break is more than twice the actual value; furthermore, from the relatively high pressure resulting from the first break, 1,090 lb/sq in, it is probable that the amount of gasification was very much greater than in the other two reclosing tests, and sufficient to bring about an appreciable loss of oil, with consequent reduction of second break pressure. It seems apparent, therefore, that the cross jet pot pressure on reclosing tests may be reduced on the final break, particularly where the severity of first break operation is high. The general performance of the oil circuit breaker is, however, not adversely affected by the reduction in oil content.

It is to be expected that there would be a pressure rise immediately before " contact-make " during closing operations. The magnitude is limited, however, by the short duration for which the arc can persist in a rapidly decreasing gap. The reclosing test oscillograms record this pressure, and it will be noted that the values are of small magnitude in spite of the possible existence of hot gases in the arcing chamber.

(*To be concluded next week.*)

* " Calculation of the Pressure in the Arc-Quenching Elements of Circuit Breakers," by B. V. Malevinskii, *Elektrichestvo*, No. 11, pp. 44–48, November, 1948.

South American Prospects

AFTER a tour of about 20,000 miles in Central and South America and the Caribbean area Sir George Nelson, chairman of the English Electric Co., Ltd., and its associated concerns, returned to London last week. The tour was sponsored by Government Departments and the Federation of British Industries.

Sir George found that many people in the countries which he visited were not fully informed about the problems which Great Britain had had to overcome after the war in her endeavour to regain her position as an exporter. He discovered particularly that they were not aware of the improvement in delivery periods which British industry had achieved. He impressed upon those he met that Great Britain possessed a special flair for scientific research and technical achievement and skill and experience in making things which the world needed. Our goods were fully competitive with those of other countries and their quality was unsurpassed.

He was much struck by the favourable attitude of Government and industrial leaders towards Great Britain and British manufacturers. Among the personalities he met were the Presidents of Argentina, Brazil, Chile and Venezuela as well as senior ministers of these and other countries. He had many stimulating conversations at the highest level which are likely to result in plans for capital development in which British industry will participate. He was impressed by the vast potential natural resources of the countries visited.

One conclusion reached as a result of the tour is that it is most important for British representatives not only to be highly qualified technically but also conversant with Spanish and Portuguese. Sir George considers that with such qualifications they can find an immediate and assured market of an increasing size in Central and South America and the Caribbean area.

French Water Power

The Loire as a Tributary of the Rhône

By JAMES H. BIRD, B.A., Ph.D.

THE hydro-electric project of Montpezat forms part of the great post-war construction programme undertaken by Électricité de France. The Montpezat scheme (see Fig. 1) will be the first hydro-electric installation in France in which the waters draining to one sea are diverted to another; in this case the waters of the Loire draining to the Atlantic will be diverted to the Rhône and the Mediterranean. Though not among the largest of the post-war French hydro-electric projects, the estimated power of Montpezat, 325 million kWh per annum, is equal to nearly 2 per cent of the total French output of hydro-electric power in 1951. Special interest attaches to this scheme because it graphically illustrates some important features associated with hydro-electric development.

The two principal requirements of any hydro-electric installation are a sufficient volume of water with a sufficient height of fall. In the south-east of the Central Massif these desiderata are found separately on either side of the watershed between the drainage basins of the Loire and the Rhône. On the high plateaux of south-eastern Velay, drained by the upper Loire and its tributaries, the total precipitation is very heavy, about 50in per annum. South-east of the watershed precipitation is much less, but there is a turmoil of mature erosion where rejuvenated streams, tributary to the Rhône, are dissecting the uplifted south-eastern border of the Central Massif. Since the supply of water and the great change of altitude are found respectively north-west and south-east of the watershed, the Montpezat scheme is designed to effect a synthesis between the two.

On the high plateaux of Velay much of the precipitation

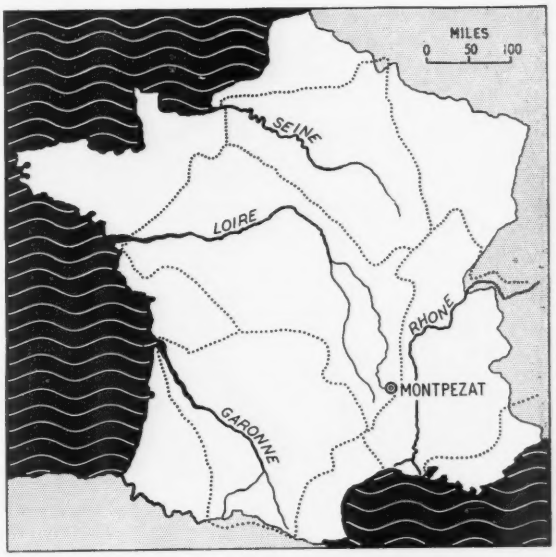
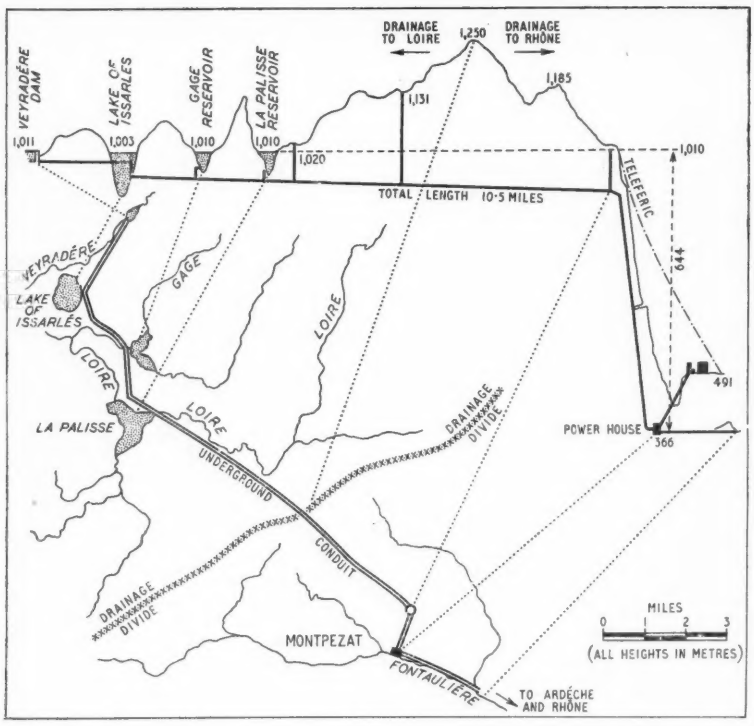


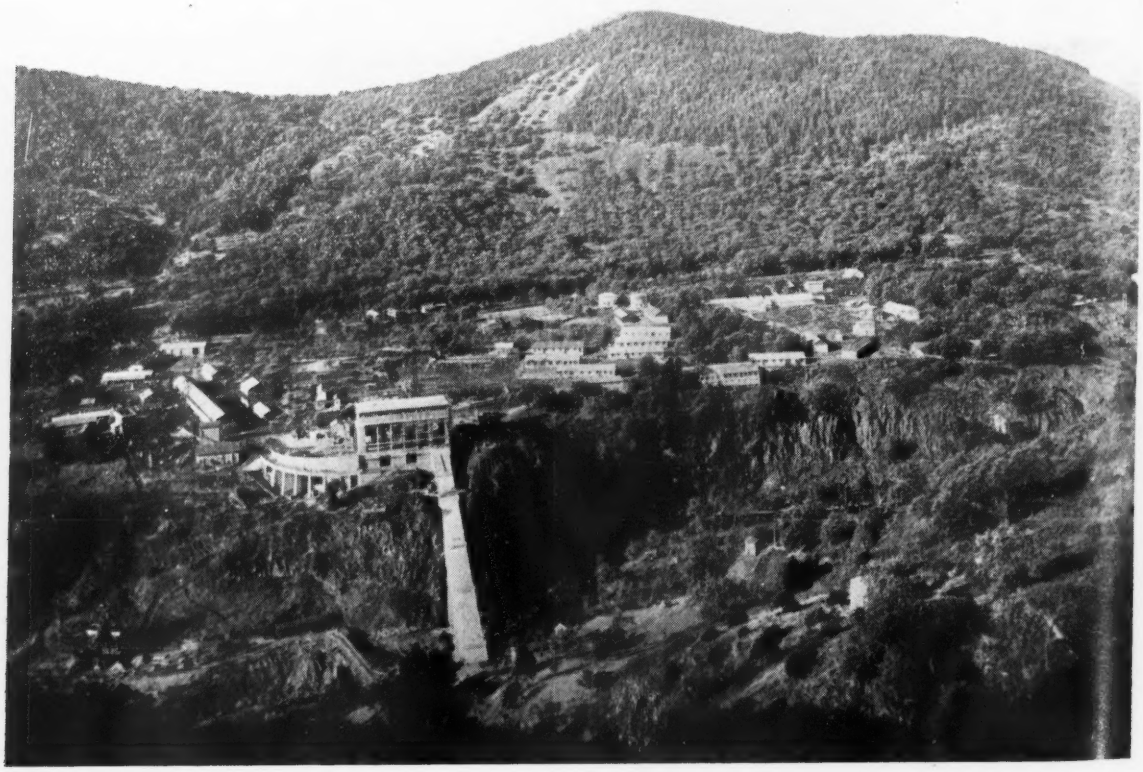
Fig. 1.—Situation of the Montpezat hydro-electric scheme. The principal drainage basins of France are also shown

Fig. 2.—The dam of La Palisse, across the upper Loire, in course of construction, October, 1952



Above: Fig. 3.—Section and plan of the Montpezat hydro-electric scheme. Below: Fig. 4.—Aerial view of Montpezat taken from the teleferic (see Fig. 3). From the surface buildings a bridge at an angle of 60 deg plunges away from the camera, across the gorge of the Fontaulière, to the power-house underground

arrives as snow, or from short Mediterranean-type storms in spring and autumn, after air from the south-east has made the 1,000m ascent of the Cévennes. Snow-melt and the fleeting nature of the rain storms cause great seasonal variation in the discharge of streams. The Loire, at its confluence with the Veyradère (see Fig. 3), has a flow which varies from $1m^3$/sec in August to 30–35m^3/sec in spring and autumn. Because of such great variation reservoirs to regulate the flow are needed if the streams are to provide power. Fortunately, the streams of south-eastern Velay are in youthful valleys, cut V-shaped into crystalline rocks (see Fig. 2). This simplifies the problem of finding suitable sites and foundations for dams and reservoirs. In addition there is the natural reservoir of the lake of Issarlès, which has a diameter of one mile and is 108m deep. It occupies a *maar* which is a volcanic crater in crystalline rock. The water from these reservoirs is to be led across the watershed in an underground conduit over 10 miles long (see Fig. 3). Since the granite country has been diversified by volcanism, the tunnel departs from a straight line to avoid passing through basaltic rocks. For the construction of the underground conduit only four adits were used,



including the two vertical shafts shown in Fig. 3. The shaft above the fall is to be used to balance the final flow.

South-east of the watershed the River Fontaulière flows in a gorge. It is a left-bank tributary of the River Ardèche, itself a tributary of the Rhône. The site of the power-house has been excavated 60m below the bed of the Fontaulière (see Fig. 3) to obtain a fall of 644m, at a velocity of 22m³/sec. Entry to the underground power-house is by the lift inside the bridge and tunnel which connect with the surface buildings (the transformer stations and the maintenance and administration building). The bridge is at an angle of 60 deg across the Fontaulière (see Fig. 4) and will also carry the cables transporting the power produced underground.

No pumping will be required. The lake of Issarlès will serve as a source of supply during the winter months, and it will be possible to drain it from its maximum height (1,003m) down to a level at 950m to supplement the resources of the Gage reservoir. However, Électricité de France has agreed that the level of the lake shall be restored to its maximum height during the period from 15th June to 15th September. This is the tourist season when the lake is a big scenic attraction for summer visitors. In return for the use of the waters of the lake Électricité de France has agreed to build a tourist hotel on the borders of the lake.

Since the area affected by the new reservoirs is very sparsely populated (Montpezat and Issarlès are the largest villages, with populations of only 1,016 and 657 respectively), there is no question of submerging any settlement or of causing any hardship to the rural population. Only the poorest quality land will be directly affected. At present, the dams are constructed, the underground conduits have been bored, and the installation of the power units in the underground power-house has been practically completed. Montpezat is due to begin producing power by the autumn of this year.

Two further characteristics of hydro-electric schemes are well illustrated by Montpezat. Firstly, the scheme will bring no prosperity or additional population to the region in which it is established. The 1,200 workers, who are now lodged in temporary buildings, will disappear the moment the construction work is complete, and the development of power will require only a few highly-skilled supervisors.

Secondly, there is the huge capital outlay required, about £8 million. This is a characteristic of modern hydro-electric projects because all the easily developed sites have long since been exploited. Such a vast initial expenditure explains why scarcely any other organization but the State can undertake modern hydro-electric development. However, in contrast with other methods of obtaining power, the running costs are negligible, and it is estimated that Montpezat will have paid for itself by 1959, if there is taken into account the saving in coal and oil. Thus the diversion of the headwaters of one of the greatest rivers of France has become a practicable feat and will represent a great addition to the hydraulic power resources of France.

Acknowledgment is due to Électricité de France for supplying the technical details upon which this article is based, and also for permitting Mr. H. Barranger to take the photographs.

The Hire-Purchase Bill

TOWARDS the end of 1953 Sir Wavell Wakefield, M.P., presented a Private Bill to the House of Commons in connection with hire-purchase. That Bill has survived the Commons and, having passed its second reading in the House of Lords on 15th June, is now well on its way to receiving the Royal Assent as the Hire-Purchase Act, 1954. The purpose of this Bill is to extend the application of the Hire-Purchase Act, 1938, and the Hire Purchase and Small Debt (Scotland) Act, 1932, and to make certain procedural amendments in regard to postponed orders for the delivery up of goods made by the Courts under the 1938 Act. It is to come into operation one calendar month after receiving the Royal Assent.

The Hire-Purchase Act, 1938, applies to England and Wales only. Any hire-purchase or credit-sale agreement under which the hire-purchase or total purchase price does not exceed, in the case of " a motor vehicle or railway wagon or other railway rolling stock," £50, in the case of livestock, £500, or in any other case, £100, is governed by the Act. The Bill, taking a realistic view of the reduced purchasing power of money since 1938, seeks to modify this by decreeing that the Act shall apply to *all* transactions where the hire-purchase or total purchase price does not exceed £300 (except for livestock, where the limit is increased to £1,000). The new measure, when it comes into operation, will, of course, apply to all new agreements within the limits set. But it is provided that certain parts of the 1938 Act shall apply also to agreements within those new limits which have been entered into previously. These cover the following matters.

Where a hirer has entered into two or more separate agreements with the same owner and makes a payment to the owner which is insufficient to cover the total amount due, he has the right to appropriate it to each agreement as he thinks fit. But, if he does not so appropriate it, the owner must, notwithstanding any agreement to the contrary, distribute the sum paid between the agreements in proportion to the amounts owing under each of them.

An owner may not re-possess goods without an order of the Court in cases where one-third or more of the hire-purchase price has been paid; if he does so, the agreement determines automatically and the hirer can recover all payments made. If a later agreement incorporates an earlier one under which one-third of the hire-purchase price has already been paid, one-third will be deemed to have been paid under the later one.

Actions commenced and Court Orders made after the 1954 Act is in operation must conform with the requirements of the 1938 Act (as amended), whether or not the agreements were entered into after the 1954 Act, provided they fall within the new limits.

The Hire Purchase and Small Debt (Scotland) Act, 1932, governs hire-purchase and credit-sale agreements made in Scotland for articles which do not exceed £20 in value. The 1954 Act will increase that figure to £300; but it will not be retrospective in any way, so that only agreements entered into after its commencement will be affected.

The new Act will obviously have its greatest effect in Scotland. So far as electrical trading interests are concerned, the increase from £20 to £300 will mean that many forms of agreement will have to be revised. But in England and Wales its effect will be felt only in certain directions, for the present upward limit of £100 covers the bulk of the more expensive electrical equipment, such as refrigerators and television sets, which are normally sold on hire-purchase terms.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

AFTER forty-three years' service with the British Thomson-Houston Co., Ltd., thirty-five of which have been spent on a.c. motor design, **Mr. W. McConnachie** is retiring. He joined the B.T.H. Test Department in 1913 on completing a course at the Royal Technical College, Glasgow. In 1919 —after service in H.M. Forces in the 1914-18 war—he became a member of what was then known as the A.C. Engineering Department at Rugby and he eventually became recognized as an authority on the fundamentals of a.c. motor design. In particular, he made valuable contributions to the early development work on change-pole motors, frequency changers and stator and rotor units for the machine tool and mining industries. Mr. McConnachie is an associate member of the American Institute of Electrical Engineers.

The Association of Supervising Electrical Engineers has announced that **Mr. Bryan Donkin,** B.A.(Cantab.), M.I.E.E., M.Am.I.E.E., M.Soc.C.E. (France), has accepted the invitation of the Executive Council to become president in succession to **Mr. C. T. Melling,** M.Sc.Tech., M.I.Mech.E., M.I.E.E., who is retiring after two years in office. Mr. Melling will introduce the new president at the first meeting of the London National Lecture session to be held at the Institution of Electrical Engineers on 26th October.

Mr. Donkin is the son of the late Mr. S. B. Donkin, who was president of the A.S.E.E. during the years 1928-31. He received his education at Gresham's School, Holt, Norfolk, and at Pembroke College, Cambridge. He was a post-graduate apprentice with the English Electric Co., Ltd., at the Stafford, Preston and Rugby Works, and then spent a year with the General Electric Co. of America, at its works at Schenectady, N.Y., and Pittsfield, Mass. On returning to England he took a post as assistant engineer with Kennedy & Donkin, consulting engineers, and was made a partner in 1933. He has been mainly concerned with high voltage transmission lines and substations for the Central Electricity Board (now the British Electricity Authority) and is at present engaged on part of the 275 kV supergrid. He is also interested in combined generation of heat and electricity for industrial purposes and for district heating.

Mr. Bryan Donkin

Mr. A. J. Locke has been appointed manager of the Hong Kong service depot of the Marconi International Marine Communication Co., Ltd. He has been a member of the Hong Kong technical staff for some time, and takes over his new post immediately. Mr. Locke joined the Marconi Marine Co. in 1936, and after holding various positions was appointed an inspector at Hong Kong in 1950. He succeeds **Mr. A. P. Goodman,** who has now completed his tour of service there and is returning to the United Kingdom to take up other duties.

Mr. A. Coppock, M.S.M.A., has been appointed sales manager of the Universal Boilers & Engineering Co., Ltd., in succession to **Mr. J. S. Selley.** After serving his apprenticeship with the Burnley Corporation Electricity Department, and following a period as junior charge engineer, Mr. Coppock was for several years in charge of the Department's sales organization. In 1935 he was appointed as sales engineer in the North of Britain for Moffat electric cookers, eventually becoming sales manager in 1938 for Moffat, Ltd. Upon the closing down of the English branch of Moffats, Mr. Coppock was appointed by his present company to inaugurate and develop its service and repairs division which he will continue to control.

Mr. R. Willis, M.I.P.E., and **Mr. P. E. H. Wilde** have been appointed directors of the Sheffield Forge & Rolling Mills Co., Ltd., the newly acquired company of the Darwins Group. Both Mr. Willis and Mr. Wilde are directors of Darwins, Ltd.

Mr. J. F. Lockwood, chairman and managing director of Henry Simon, Ltd., has been appointed to the boards of Electric & Musical Industries, Ltd., the Gramophone Co., Ltd., and the Columbia Gramophone Co., Ltd.

Mr. J. M. Grammer has been elected chairman of the London Branch of the Purchasing Officers Association.

Mr. H. F. Hudson, M.I.E.E., who has been manager of Worcester and Malvern District of the Midlands Electricity Board since 1948, has been appointed to the staff of the Worcester and District Sub-Area headquarters at Whittington as from 1st July.

Mr. E. C. Watson, Associate I.E.E., manager of the Kidderminster District of the Worcester and District Sub-Area, has been appointed manager of the Worcester and Malvern District in succession to Mr. Hudson. Mr. Watson held various appointments with the Shropshire, Worcestershire and Staffordshire Electric Power Co., and when the industry was nationalized in 1948 was district manager at Bromsgrove. Since August, 1948, he has been district manager at Kidderminster.

Miss G. L. Entwisle, A.M.I.E.E., one of the first women in this country to be an electrical engineer, retired on 30th June after over thirty-eight years' service with the Metropolitan-Vickers Electrical Co., Ltd. In 1915, when she joined the technical staff of M-V from Manchester University where she studied physics, she was the first woman to be so employed, and she later had the distinction of becoming the first woman student, then graduate, and finally an associate member of the Institution of Electrical Engineers. In 1927 she broadcast on the subject of "Women in Industry." From 1941 to 1943 Miss Entwisle was president of the Women's Engineering Society, founded by Lady Parsons in 1920, succeeding Dame (then Miss) Caroline Haslett in that office; during that period she helped to form the Manchester Branch of the Society. She was an executive member of the E.A.W. Council from its inception and became the first secretary of the Manchester Branch formed in 1926.

Miss G. L. Entwisle

On taking her leave Miss Entwisle received presentations (including an electric hair dryer) from her electrical engineer colleagues and friends and from the M-V Long Service Association. In expressing her thanks Miss Entwisle recalled some of the early days. The idea of a woman engineer was so strange and prejudice was so strong that there were rumours of draughtsmen walking out, but ultimately all these difficulties were surmounted, and she became accepted on equal terms with the men.

Mr. M. Crookes, Associate I.E.E., has been appointed power station superintendent at Blackburn Meadows power station of the Yorkshire Division of the British Electricity Authority and will take up his new duties on 1st August. Mr. Crookes is at present deputy station superintendent at

Neepsend power station. From 1939 to 1946 he was shift charge engineer at Neepsend, and for the next two years held a similar appointment at Blackburn Meadows. He returned to Neepsend in 1948 as operation engineer and became deputy station superintendent in the following year.

Mr. R. E. P. Briebach and **Mr. Michael Parkinson** have joined the board of F. & A. Parkinson, Ltd., Guiseley (a company in the Crompton Parkinson group). Mr. Michael Parkinson, after graduating at Cambridge, joined F. & A. Parkinson, Ltd., and later was commissioned in the R.E.M.E. On his return to civil life he undertook an intensive study of the works and offices of Crompton Parkinson at home and abroad and after this was appointed assistant general manager of the Guiseley works and assistant to the works director (North). More recently he was appointed general manager of the electric motor works at Guiseley. He served for one year on the junior board and was later co-opted to the board of executive directors of Crompton Parkinson, Ltd.

Mr. Briebach joined F. & A. Parkinson, Ltd., in 1931, and during his service with the Crompton Parkinson group he has been concerned with the development and production of lamps and, later, lighting fittings. He is general manager of the whole of the lamp and lighting fittings manufacturing sections of the company, and he has been an executive director of Crompton Parkinson, Ltd., since 1946.

Mr. C. A. J. Martin, G.C., M.C., B.A., A.M.I.E.E., M.Inst.R., has been appointed an executive director of Crompton Parkinson, Ltd. Mr. Martin was educated at Trent and Cambridge and has had over twenty-four years' service with the company. In this period he has held various posts in the sales organization and for the past three years has been general manager of the plant sales division. After serving on the junior board Mr. Martin was co-opted to the board of executive directors early in 1953. He held commissioned rank in the Royal Artillery in the 1914-18 war and in the Royal Engineers in the last war.

Mr. Bernard Moore has relinquished his appointment as executive director of Crompton Parkinson, Ltd. (after serving for eight years in that capacity), on his retirement from the company's service. He has been connected with the company for over thirty-one years, first as production engineer and later as works director of the company's northern works and general manager of the Guiseley motor works. At the June meeting of the board of Crompton Parkinson, Mr. Moore was entertained to lunch and was presented by the chairman of the company with a silver rose bowl and a cheque in connection with his retirement.

Mr. J. Palmer Rees, superintendent of the Llynfi power station, has retired after forty-seven years in the electricity supply and contracting industries in Britain and India. Mr. Rees served his apprenticeship with the Electric Construction Co., Ltd., Bushbury, and was for a time with B.T.H., Rugby. From 1911 to 1920 he was assistant electrical superintendent of power station construction and operation for the India Peninsula Railway, Bombay. In 1920 he joined the South Wales Power Co. at Upper Boat, where he remained until 1940. He was then appointed electrical superintendent at Little Barford power station, becoming superintendent at Llynfi in 1943.

Mr. J. Exley, A.M.I.Mech.E., A.M.I.E.E., M.Inst.F., at present deputy station superintendent at Huddersfield, has been appointed to a similar post at Kirkstall power station as from 1st August. From 1946 to 1947 he was shift charge engineer at Stoke, and for the next two years was shift charge engineer at Ferrybridge, becoming operation engineer at that station in 1949. He went to Huddersfield in 1951.

Mr. William M. Cagney has been appointed regional supervisor for the activities of the Pye group of companies in the U.S.A., with offices in the Fifth Avenue Building, 200 Fifth Avenue, New York. Mr. Cagney, formerly sales manager and manager of the Sales Engineering Department of the Link Radio Corporation, has specialized in the design and sale of many large mobile and point-to-point radio systems.

Mr. G. D. L. Goslett, O.B.E., has been appointed to the board of the Ruberoid Co., Ltd. He joined the company in 1934 as advertising manager. During the war he served as an officer in the R.A.F., attaining the rank of squadron leader, and on his return in 1946 was promoted to sales manager. He will continue to control the home sales division of the company. **Mr. C. B. Innes,** the company's accountant, and **Mr. D. L. Irwin,** jun., general works manager, have also been appointed to the board.

Mr. Edward A. O'Neal, jun., chairman of Monsanto Chemicals, Ltd., has resigned from the board of Monsanto Chemicals (Australia), Ltd., and **Mr. P. A. Singleton,** managing director of Monsanto Chemicals, Ltd., has been elected in his place. As chairman of the British company, of which the Australian company is a subsidiary, Mr. O'Neal will continue to take a close interest in its affairs.

Mr. G. E. Collier informs us that he is a corporate member of the Institute of Industrial Administration and not an associate as stated in our last issue.

The London area finals of the **Electrical Industries Benevolent Association Golf Championship** took place at the Berkshire Golf Club, Ascot, on 1st July, when an enjoyable day was had by sixty-four competitors, amongst whom were Sir Henry Self, chairman of the National Committee, who presented the prizes in the evening, and Mr. E. A. Mills, chairman of the London Area Committee. The handicap winner was Mr. H. Pugh, who had a score of 76 minus 7, 69 net, with Mr. A. C. Stewart and Mr. R. W. Bassil tying for second place with 71 net. The best gross score was returned by Mr. A. E. Taylor with a round of 74, which is the par value for the course. These winners will go forward to the national finals to be held at Moor Park, Rickmansworth, on 4th October. After lunch a Greensome Stableford competition was played. Mr. E. J. Beaver and Mr. C. F. Boyes were the winners with Mr. W. J. Bird and Mr. L. H. Welch as the runners-up.

As the result of a play given at the Crane Theatre, Liverpool, by the **Electron Players,** on behalf of the Merseyside and North Wales Branch of the Electrical Industries Benevolent Association, £70 has been handed to the Association's fund.

There were some eighty exhibits at the annual flower show of the **Crompton Parkinson, Ltd.,** Social Club held recently in London, the exhibits ranging from floral blooms to a wide variety of fruits and vegetables. The prizes for the best exhibits were presented by Mrs. J. B. Scott, wife of the sales director.

In the annual challenge shield match between a team representing the **Midland Radio Industry Golfing Society** and **Lancashire and Cheshire R.I.G.S.,** the Midlanders won by seven games to one, avenging their last year's defeat by the Northerners, who then won by one game. This year's match was played over the Edgbaston (Birmingham) course on 30th June.

The **Telcon Social and Athletic Club** held its annual sports meeting at Kidbrooke sports ground on 26th June in traditionally fine weather. The "Sir Geoffrey Clark Challenge Cup" was won for the third year in succession by Submarine Cables, the runners-up being the Plastics Division. Johnson & Phillips, Ltd., challenged Telcon to sack football and won by six goals to nil.

Other attractions included a children's fancy dress parade and competition, and a marching display by the Sidcup and Chislehurst Sea Cadets Band. Among those present were Councillor T. L. Dawes, J.P., the Mayor of Greenwich, the Mayoress and their daughter. The prizes were presented by Lord Colgrain, chairman of the Telegraph Construction & Maintenance Co., Ltd.

The annual dinner and dance of the football section of the **Plessey Social and Sports Club** was held recently at the Valentines Hotel, Ilford, and was attended, among others, by Mr. T. White Wilson, president of the football

club, Mr. John Clark, vice-president, Mr. and Mrs. Bedford Attwood, Mr. and Mrs. E. H. Ouston and Mr. B. A. Campbell, warden of the Peel Institute, and Mrs. Campbell. Squadron Leader A. E. Cooper, O.B.E., Member of Parliament for Ilford South and Parliamentary Private Secretary to the President of the Board of Trade, was also among the guests, and spoke during the dinner.

Despite dull weather a gathering of almost 2,000 people, members of the staff with their families and friends, attended the annual family day fête and gala of the **Southern United Telephone Cables, Ltd.,** at the Dagenham Cables Sports Club ground, Dagenham, Essex, last Saturday. The programme included forty events of all kinds, a horticultural show and an arts and crafts exhibition. An exhibit which attracted a great deal of interest was "The World in Colour," a series of photographs exhibited by the Earl of Verulam, who took them during his travels at home and abroad, including his Moscow visit. There was also an R.A.F. physical training display and a juvenile horse show jumping competition. At the close of the sports Mrs. W. F. Bishop, wife of the chairman, presented the inter-departmental trophy to the office section, and the horticultural challenge cups to the winners. The sideshows were well patronized.

OBITUARY

Sir Maurice G. Simpson, C.S.I., M.I.E.E., formerly of the Indian Telegraph Department, and from 1933 to 1947 a director of W. T. Henley's Telegraph Works Co., Ltd., died on 2nd July at the age of eighty-nine.

Sir Maurice entered the Indian Telegraph Department in 1887, and became Electrical Engineer-in-Chief in 1906, retiring from India in 1914. He joined the Indo-European Telegraph Department of the India Office in the following year and from 1923 to 1931 was Director-in-Chief. He was knighted in January, 1931.

Dr. J. H. Dobson.—The death occurred on 29th June in South Africa at the age of seventy-five of Lt.-Col. Joseph Henry Dobson, D.S.O., D.Eng., D.Sc., M.Sc., M.I.E.E., the well-known engineer. Dr. Dobson was born at Crewe and served an apprenticeship with the former London and North Western Railway. He went to South Africa in 1904 and for five years was Professor of Electrical Engineering at the old Transvaal University College, now Witwatersrand University. From 1909 to 1911 he was town electrical engineer of Johannesburg and from the latter year to 1919 he was general manager and chief engineer of the gas and electricity supplies and tramways of Johannesburg. He saw active service in the East African campaign in 1916-17, and in 1920 joined Dowson & Dobson, Ltd., of which he was chairman and managing director at the time of his death. He was one of the first directors of the South African Iron & Steel Industrial Corporation at Pretoria, of which he was also general works manager, but resigned from the Corporation in 1935. He was president of the Association of Municipal Electrical Engineers of South Africa in 1915, of the South African Institution of Electrical Engineers in 1917, and of the S.A. Institute of Mechanical Engineers in 1911. The South African I.E.E. awarded him its gold medal in 1917. He was also a member of the Institutions of Civil and Mechanical Engineers.

Mr. James Mirrey, B.Sc., M.I.E.E., who was manager of the drawing office of A. Reyrolle & Co., Ltd., until his retirement in 1948, died on 26th June at the age of seventy, after a prolonged illness. Mr. Mirrey received his early education in Newton Stewart, at the Ewart High School, and subsequently attended the Royal Technical College, Glasgow, and Glasgow University. During the vacations he worked with William Denny & Bros., shipbuilders, Dumbarton, and afterwards he joined Vickers, Son & Maxim, Ltd., working in Sheffield on switchboard and electrical installation work and on the testing of turbo-generators. Later he was transferred to the Barrow Works of the same company, and had experience in the manufacture of switchgear for submarines and of electrical equipment for gun-mountings. In 1909 he was appointed draughtsman, and later senior draughtsman, at Barrow, and was responsible for the design of switchgear of all types for submarines and for the control-schemes associated with this work. In 1912 he joined A. Reyrolle & Co., Ltd., as a senior draughtsman, later becoming chief designer and finally manager of the drawing-office. During this period he took a leading part in the development of metalclad switchgear and protective systems.

Mr. William Simpson, Associate I.E.E., M.Inst.F., chief generation engineer (operation), South West Scotland Division, British Electricity Authority, died on 28th June at his home, 23, Stewarton Drive, Cambuslang, in his sixty-first year. Mr. Simpson served his engineering apprenticeship with Duncan Stewart, Glasgow, and joined the Clyde Valley Electrical Power Co. in 1914, with which company he held the positions of shift charge engineer (1918) and superintendent at Clyde's Mill power station (1925). He became superintendent of the company's power stations in 1947. On nationalization in 1948 he was appointed generation engineer (operation) of the South West Scotland Division and had been chief generation engineer since May, 1953.

Mr. T. C. Hunter, M.B.E., Associate I.E.E., died suddenly on 1st July at his home at Cupar, Fife. He joined the Fife Electric Power Co. in 1911 as junior charge engineer at the Townhill power station, Dunfermline. In 1912 he was posted as assistant distribution engineer in Wemyss and district and returned to Dunfermline in 1917 as an assistant on e.h.v. construction, eventually becoming construction engineer. He was thereafter appointed assistant district engineer in the western area where he remained until 1938. He was then put in charge of the eastern area of the county, which position he held at the time of his death. He took an active interest in the Electrical Power Engineers' Association, serving since 1933 on the Scottish Division Council. He was also a member of No. 13 Area (Scottish Investigation Committee) and the District Joint Board of which he was twice chairman.

WILLS

Mr. J. K. Brydges, Eastbourne's borough electrical engineer for over 30 years, who died on 7th March, left £40,[illegible]9 gross (£40,745 net).

Mr. P. Butler, director and joint general manager of Bruce Peebles & Co., Ltd., who died on 21st September, left personal estate in England and Scotland valued at £8,105.

Mr. G. E. Taylor, late technical investigation officer (electrical) with London Transport, who died on 18th January, left £7,138 gross (£6,886 net).

Mr. E. B. Walden, director of Premier Electric Heaters, Ltd., who died on 24th March, left £7,072 gross (£6,805 net).

Mr. R. W. Kennedy, late editor of the *Electrical Contractor*, who died on 17th December, left £3,997 gross (£3,884 net).

Mr. J. McCombe, Ph.D., M.I.E.E., senior overhead lines engineer in the Chief Engineer's Department of the Yorkshire Electricity Board, who died on 3rd March last, left £2,903 gross (£2,776 net).

Mr. M. M. Wyatt, A.M.I.E.E., formerly acting local manager, Southern Sub-Area, London Electricity Board, who died on 25th January last, left £30,670 gross (£30,308 net).

Mr. A. E. Darlington, formerly for 43 years with the British Thomson-Houston Co., Ltd., who died on 28th February last, left £5,933 gross (£5,553 net).

Mr. J. H. Ward, formerly electrical engineer, Eastbourne, who died on 6th February, left £62,627 gross (£62,180 net).

Mr. B. B. Granger, retired electrical engineer, Radcliffe-on-Trent, who died on 18th January, left £25,898 gross (£25,735 net).

Mr. H. J. Hornby, chairman and managing director of A. Gallenkamp & Co. Ltd., who died on 2nd November, left £38,827 gross (£31,858 net).

Atomic Power in Russia

Last week Moscow Radio announced that on 27th June the first industrial atomic power station began operation. It was said to have a capacity of 5,000 kW and it was further announced that Russian scientists and engineers were engaged in the construction of atomic power stations with capacities of from 50 to 100 MW.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Load Factor

NOW that sufficient generating plant to meet all demands and to eliminate the bogey of load-shedding has been provided, it is encouraging to see that emphasis is being placed on the improvement of load factor. The policy is to improve the load factor by greater diversity of use, which is the reason for the present anxiety to develop the domestic load. Previous efforts in this direction have been "intense direct electricity selling" and "load building."

By the very nature of the commodity, continuity of supply is essential and the consumer is placed in the happy position of having a "help-yourself" unrestricted supply. This position is unfortunately incompatible with good load factor and efficient generation and supply.

Because of this position there have been great fears about what would happen to peaks, if certain desirable loads were pushed too far, and many engineers have shown apprehension about their networks in connection with space heating. These apprehensions were realized when the restrictions of supply occasioned by war forced wholesale "cuts" in domestic supplies in the vital interest of factory production.

While "control" of consumers' loads is generally considered objectionable there certainly is a case for it, if thereby load factor can be improved and charges to the consumer reduced. This is particularly true when control is restricted to non-essential loads such as water heating. Under emergency conditions, hardships could also be alleviated by the selective shedding possible with control. Water is an essential commodity provided by a "help yourself" service, yet restricted use is enforced at times of short supply.

That many existing installations of central ripple control prove the value of the control is evident from the increasing number that are being installed. Quite recently the technical Press reported that one overseas authority had placed an order for ripple control equipment to the value of £360,000.

In view of the extreme importance of this subject and at least the partial solution offered by central ripple control, Mr. H. J. Beard's contribution to the discussion on Mr. D. Bellamy's paper read at the British Electrical Power Convention at Eastbourne is of considerable significance. In this he commented that:—"In view of the high cost of generating plant it had been necessary to consider every way of reducing the maximum demand. Attention had therefore been given to the remote control of water heaters without inconvenience to consumers, and in a large town in Southern Rhodesia it was considered that when the load grew to 110 MW it might be possible by this means to reduce the peak demand by 20 MW."

Unfortunately, tests of a really large installation do not appear to have been carried out in this country, though such as have been carried out appeared to indicate very promising results; doubtless tests on a significant scale will be made as soon as opportunity permits.

Confirmation of the confidence placed by overseas electricity supply engineers in the value of central ripple control would certainly pave the way to solving the problem of load factor and to removing apprehensions in the supply industry over otherwise uncontrollable and dangerous peaks.

Liverpool. J. F. MACKENZIE.

Engineering Qualifications

MAY I be permitted to disagree with "Plain Mr." when he suggests that lack of finance is a reason for not obtaining qualifications? My engineering career started in 1918 at the age of 14. I, too, had to earn my keep, so an apprenticeship was out of the question. By 1923 I was earning enough to pay for evening classes, by means of which I passed the graduateship examination of the I.E.E. Had I been capable I could have obtained a degree by the same method, as some of my colleagues succeeded in doing. Eventually promotion came my way and I became an A.M.I.E.E., the goal at which I aimed in 1918.

"ONE OF MANY."

Domestic Heating

I AM sorry to prolong this correspondence but Mr. Whitehorn does imply that there is something wrong in restricting chimney throats.

I would emphasize that the ordinary open fire uses anything from 7,000 to 10,000 cu ft of air per hour. By using a free standing fire of the "Hurdapta" type, this can be reduced to 2,500 cu ft, which is about the figure recommended by the authorities as a desirable room air change.

London, W.1. A. C. HAZEL,
Managing director,
Hurseal, Ltd.

CAUSES OF FIRES

THE Report of the Fire Research Board, with the Report of the Director of Fire Research, for the year 1953 has just been published for the Department of Scientific and Industrial Research and Fire Offices' Committee by H.M. Stationery Office (2s 6d). The report shows that 91,768 fires were attended by the N.F.S. and Fire Brigades in 1952 as compared with 72,496 in 1951, 71,874 in 1950, 101,828 in 1949 and 64,778 in 1948. In 1952, 46,696 of the fires were in buildings, the figures for the previous four years retrogressively being 42,394, 43,744, 42,792 and 37,246. Complete statistics for the year 1953 are not yet available but the total number of fires attended was about 87,000.

The Report shows that most fires occurred in private residential houses and flats and the figures have risen from 16,667 in 1948 to 22,438 in 1952. Of these, fires due to electrical appliances, etc., rose from 6,085 in 1948 to 8,008 in 1952. The number of fires due to lightning increased from 95 to 196 during the same period, while fires due to static electricity fell from 19 to 8. Of these fires, 2,353 in 1948 and 2,728 in 1952 were caused by electric wires and cables. The rates of incidence for fires in pre-war and post-war temporary houses have shown signs of increasing although the figures for house damage have remained relatively the same. Among these temporary houses, the chief causes of fire were electric wire and cable. In permanent new "traditional" post-war houses the rate of incidence is lower than in pre-war dwellings.

PARLIAMENTARY REPORT

AFTER a two-day debate, in which the Government proposals were severely criticized, the Television Bill has been read a second time in the House of Lords by 130 votes to 64.

Railway Electrification

Mr. Parker asked the Minister of Transport what progress had been made with the electrification of the London–Tilbury Line.

Mr. Lennox-Boyd said that the British Transport Commission told him that the technical planning for this electrification scheme was well in hand. The plans for the engineering works at Barking, which included a new fly-over and complete reconstruction of the station, were nearly complete. These and other preliminary engineering works, some of which had been started, must precede the electrification itself and would take some years to complete.

Electricity in British Guiana

Mr. David Jones asked the Secretary of State for the Colonies whether he was aware of the dissatisfaction in British Guiana at the failure of the Demerara Electric Co. to make available to the inhabitants of the colony a plentiful supply of electrical power; and whether he would take advantage of the review which was due in August of this year to terminate the contract, and set up instead a publicly owned corporation to run the undertaking on a non-profit-making basis.

Mr. Lyttelton said he understood that the company would have ample power to meet the demand in the area which it served, that is to say, Georgetown and its suburbs, when additional plant was installed in October. In addition, the company had been required to undertake certain improvements within the next three years and, provided it did so, there was no power to terminate its franchise until 1977. In these circumstances, Mr. Lyttelton said he did not think that further action was necessary.

American Plant Contracts

Mr. Jay asked the President of the Board of Trade what representations he had made to the United States Government about the grant of further contracts for the Chief Joseph and Dalles dams to United States firms, by the United States Army Department although the English Electric Co. had submitted a tender at a substantially lower price.

Mr. Heathcoat Amory said that representations stressing the importance we attached to the decisions on these contracts were made while they were under consideration by the United States authorities. In view of the award, instructions had been sent to our Ambassador in Washington to make representations at the highest level, expressing our disappointment that this decision did not follow the more liberal policy which appeared to be foreshadowed by the President's message to Congress.

Mr. Jay asked if the British prices were not in these cases substantially below the American prices. In view of all that had been said by American leaders about the need for "trade, not aid" in respect of competitive British products, was it not deplorable that this kind of thing should happen?

Mr. Amory said he agreed that the differential in these cases was substantial. The result was extremely disappointing.

A Scottish Factory

Mr. Patrick Maitland asked the President of the Board of Trade at whose expense the Sunbeam Electric Co.'s factory at East Kilbride was to be built; whether it would be let or sold to the company; and what was the estimated cost of construction of the factory.

Mr. Henry Strauss said that the factory would be built by Scottish Industrial Estates, Ltd., with funds provided by the Board of Trade under the Distribution of Industry Acts, 1945 and 1950, and would be let to the company. It would not be in the public interest to disclose the estimated cost of the factory.

Supplies to Churches

Mr. George Craddock asked the Minister of Fuel and Power if he would give a general direction to the British Electricity Authority that church premises were no longer to be charged on the standard commercial tariff for electricity consumption.

Mr. Joynson-Hicks said he would not. The majority of the Area Boards had arrangements for churches based on the special nature of their use of electricity, so that churches usually paid less than if they were charged as commercial undertakings.

Costs and Tariffs

TARIFFS in the Eastern Electricity Board's area are to remain in force without increase until 1st April next. This was reported at last week's meeting of the Electricity Consultative Council held in London under the chairmanship of Alderman W. J. Bennett. In a letter to the Council Mr. C. T. Melling, chairman of the Board, pointed out that notification had recently been received of a further rise in the price of coal and, since July of last year, there had also been two wage awards for manual workers and one salary award for clerical and administrative staff. During the last twelve months the Board had, however, made further administrative economies. The increase in the cost of coal, electrical machinery, wages and salaries was far greater in relation to pre-war prices than the increase in the price of electricity and the Board's decision to stabilize electricity tariffs until next April was made in the national interest of stabilizing the cost of production and the cost of living.

The Council considered a representation from the proprietress of a tea shop who had protested against the increase made by the Board in July, 1953, of the fixed charge of the combined domestic and commercial tariff which she pointed out represented an increase of over 400 per cent on the amount of the previous fixed charge. The Council, after carefully considering the consumer's arguments, noted that when account was taken of the unit charge the consumer's average price per kWh had, in the March quarter, only increased to 1·55d compared with the average price paid during the corresponding quarter last year of 1·11d. This latter price was extremely low and was, in fact, materially lower than the price which the consumer was paying before the introduction of standard tariffs. In the March quarter of 1952 the average price paid by the consumer had been 2·16d per kWh. The Council accordingly expressed the opinion that no useful conclusions could be drawn by comparing the component parts of the tariff separately and the tariff had to be looked at as a whole to see whether the charges were fair.

Publication of Annual Reports

The Council agreed on the form of its sixth annual report covering the year ended 31st March last. Members expressed disappointment that under the requirements of the Electricity Act, 1947, the Council's report was published together with the report of the Eastern Electricity Board which had to be laid before Parliament and consequently it would be several months before the Council's own report could be made public. The Council decided to record its view that the reports of the Consultative Councils should be published separately from those of the respective Boards in order that they could be available to consumers and all interested in the work of Consultative Councils sooner than was the case under the present legislation.

VIEWS on the NEWS

By REFLECTOR

INTERNATIONAL rivalry in the field of atomic power seems for the time being to have veered round to "peaceful" uses, which is all to the good. Russia has announced the commissioning of her first atomic generating station (5,000 kW), the United States has a number of similar projects in hand, and in this country work is going ahead on the Calder Hall and Dounreay projects. Sir John Cockcroft's latest pronouncement on this subject shows that he does not expect much to happen for another eight years, but after that (between 1965 and 1970) he envisages the provable erection of 5,000 MW of atomic power stations. These will be an appreciable addition to our electricity supply system but still hardly sufficient to compensate for the coal shortage which will be extremely acute by then.

* * *

It seems to be clear that some members of the Electrical Trades Union are determined to behave in a fantastic fashion. Last week I mentioned their decision to picket Lyons' establishments in London in an endeavour to secure public support for their strike to force the company to deal with a supervisor who declined to rejoin the Union. Now, it is reported, electricians employed by the B.O.A.C. at London Airport have decided to refuse to do maintenance work on a deep freezer because it is used for some of Lyons' products. The application of this "principle" to its logical extent opens up endless possibilities.

* * *

During the power-cut period electric clocks were badly affected. If they were not actually stopped they suffered through frequency reduction. Although any loss of time caused in this way was later made up by running the supply system at over frequency during off-peak hours, it was never satisfactory to be uncertain about the time during the day. The better performance of the supply system during the last two winters has made a significant difference and electric clock makers say that there has been a substantial increase in sales. While from the supply authorities' point of view this does not represent much in the way of revenue, at least the electric clock has a 100 per cent load factor. In this it is unique, with the possible exception of some domestic radio sets.

* * *

To rural dwellers electricity is the one service that can provide all the comforts of town life—without its disadvantages—so that the coming of the mains is quite an event. Even the erection of overhead lines is welcomed by the villagers if not by the casual visitor. *Seeboard*, the magazine of the South Eastern Electricity Board, tells of an instance in which the gratitude of a new consumer was expressed by inviting the linesmen concerned to a celebration tea which included wine, sandwiches and an iced cake decorated with an illustration of an overhead line and the words "Thank you" beneath it. This incident is related in the course of an interesting article by A. W. White which shows how the modern industry of electricity supply is helping the ancient craft of trug making. Trugs (shallow wooden baskets) have been made in Sussex since Anglo-Saxon times. Many are decorated with poker work, the poker now being electrically heated of course.

* * *

While national development of electricity from nuclear fission will take a considerable time, private enterprise in this direction seems to be doing better. I see that a doctor is reported to have lit his house by atomic energy derived from a nuclear fission "egg" which had been lent to him by a friend. Unfortunately he held himself bound by the Hippocratic oath not to divulge more information about the "egg." If it had not been for this he might have escaped a fine of £50 with £20 costs for the fraudulent use of electricity after the North Western Electricity Board had cut off his supply.

* * *

The thief masquerading as a meter reader has been known for many years but recently there seem to have been an epidemic of thefts by bogus meter readers—both gas and electricity. All meter readers presumably carry identity cards but many housewives are shy about asking to see them. Some protection is afforded by uniforms and some Electricity Board meter readers have them. It would be better if the practice were general and I am glad to see that the East Midlands Board has decided to provide uniforms for its meter readers; those Boards which have not already done this should follow suit.

* * *

Part of the "Eurovision" arrangements which have been proceeding for the past few weeks has been the televising of international football matches. Viewers watching the Germany-Austria contest at Bâle last week must have been horrified to see twenty or thirty people perched on the members of an e.h.v. transmission line tower, some of them well in the upper reaches. If the English take their pleasures sadly, some Continentals take them rather riskily.

* * *

Under the heading "Remarkable Feat in Telegraphy" in the *Electrical Review* of 12th July, 1884, a letter to *The Times* is quoted. The correspondent said:—

> "On Tuesday last I sent a telegram from East Croydon to Westminster at 20 minutes to 10 a.m., and it positively reached its destination at Bridge Street seven minutes under the hour—i.e., at 10.33. I arrived there myself (by train) at 10 minutes past 10 and thus I was enabled with a little patience to witness the arrival of my own telegram 20 minutes later. A few days ago I sent a telegram from East Croydon to Brighton, and that arrived in almost the same time. If things go on at this rate I would suggest the desirability of someone presenting a testimonial to the telegraph authorities, in order to stimulate them to still greater exploits."

This impatient correspondent of the 'eighties should be living at this hour!

INDUSTRIAL NEWS

First Atlantic Telephone Cables

THE official order for the manufacture of nearly 90 per cent of the first of the two transatlantic telephone cables to be laid between Oban and Newfoundland was placed last March by the Post Office with Submarine Cables, Ltd., owned jointly by Siemens Brothers & Co., Ltd., and the Telegraph Construction & Maintenance Co., Ltd. Submarine Cables, Ltd., has now received a further order for the second complementary Oban–Newfoundland cable, and for the single submarine cable to be used between Newfoundland and Nova Scotia.

The first cable, together with the balance being made in the United States, will be laid in 1955 and the second cable in the following year by the Post Office cable ship *Monarch*—the largest vessel of its kind in the world. The cables will be made at the new factory at Erith, which is being specially equipped for the purpose, and manufacture will commence in August.

Each main cable will be about 1,950 nautical miles (equivalent to 2,250 statute miles) in length, and will contain single-way repeaters (speech amplifiers) developed by the Bell Telephone Laboratories of America, spaced at intervals of about 37 nautical miles. The 275 nautical miles Newfoundland–Nova Scotia cable will contain two-way repeaters developed by the British Post Office, spaced at intervals of about 19 nautical miles.

The joint Anglo-American-Canadian project, of which these cables will form the main transatlantic link, will provide for thirty-six simultaneous conversations on interference-free channels between the United Kingdom and North America. The total value of the contract for these cables will amount to nearly £5,000,000, and represents the largest single order ever placed for submarine telephone cables.

Miners' Lamp Bulb Testing

The National Coal Board has set up a testing station at Treorchy, South Wales, to check the quality of bulbs supplied to it for use in miners' lamps throughout the coalfields.

The decision to institute such control was taken on the recommendation of the Board's Divisional Electrical Engineers' Conference. The South Western Divisional Board agreed to set up the new station, which has now been in operation for some months testing samples of bulbs on a national basis.

The objects of the station are to accumulate basic information about all types of miners' lamp bulbs produced by the several manufacturers, to establish routine testing, and to seek the co-operation of suppliers in achieving and maintaining a consistent quality. The testing of new types of bulbs is also undertaken before production quantities are made. The large proportion of miners' lamp bulbs are manufactured to B.S. 535 : 1953, and all testing procedure at the station conforms strictly to this specification.

Air-line Communications

The new premises of the Engineering Division of International Aeradio, Ltd., at Southall, Middlesex, were officially opened last week. The company was formed in 1947 by the major international air lines and now operates aeronautical communications, air traffic control services and other allied aids for the safety of international air transport at over 50 stations throughout the world. The move of the Engineering Division from Bovingdon Airport to the new premises has the advantage of centralizing the work of the company as these adjoin the Aerad Printing and Publishing Division at Hayes Road, Southall. After the opening speech, visitors were invited to inspect the new premises which have an area of 25,000 sq ft, and to see various items of equipment in operation.

The arena at Roundhay Park, Leeds, during the recent Northern Command Tattoo. General lighting was by 72 G.E.C. football floodlights on 90ft towers, and the wall in the background was illuminated by 48 G.E.C. floodlights for small offset with 1,000 W Class B.1. projector lamps

New Plessey Factory

A factory which will cost £100,000 is to be built by the Swindon Town Council for the Plessey Co., Ltd., Ilford, on the Council's industrial estate, which is part of the Council's plan to build houses for some of London's overspill population. The factory, which is subject to approval by the Minister of Housing and Local Government, will provide work for between 1,500 and 2,000 people.

Keenly Contested Dollar Contract

An excellent example of what British manufacturers can do in spite of rapidly increasing international competition is the news that two British firms, Auto Diesels, Ltd., and Crompton Parkinson, Ltd., have secured a substantial order from the United States Government for the delivery of mobile ground power units for the starting of jet aircraft. The value of the equipment, which is for the use of the Allied Powers, is over $1,500,000. It is understood that the contract was bid for by Swedish, French, Italian, Swiss, Belgian and German firms.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £156 0s 0d
COPPER, H.C. Electro	ton £240 5s 0d
Fire Refined 99·70%	ton £239 0s 0d
Fire Refined 99·50%	ton £238 0s 0d
COPPER Tubes ..	lb 2s 3¾d
Sheet	ton £299 15s 0d
H.C. wire and strip ..	ton £268 15s 0d
LEAD, English ..	ton £97 5s 0d
Foreign	ton £96 0s 0d
MERCURY	flask £97 10s 0d
TIN, block (English) ..	ton £754 0s 0d
ZINC, G.O.B. Foreign	ton £78 10s 0d
Electrolytic	ton £86 5s 0d
BRASS Tubes (solid drawn)	lb 1s 10⅞d
Sheet	ton £245 10s 0d
Wire	lb 2s 6¼d
PHOSPHOR BRONZE Wire	lb 3s 9⅞d
PLATINUM	oz £30 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 21¼d–21½d

Radio Trade Code

Details are given by the *Wireless and Electrical Trader* of a code of practice for the radio and television trade prepared by the Radio and Television Retailers' Association and approved by the British Radio Equipment Manufacturers' Association. The code defines the bona fide retailer and retail premises and condemns a number of

practices designed to avoid the charging of the full retail price—free aerials, free installation of electrical points, payment of licence fee, free replacements beyond the guarantee period, offering uneconomic hire-purchase facilities, etc. The necessity for providing adequate service arrangements is stressed.

Liverpool Synchro-Cyclotron

The *Manchester Guardian* reports that the 400 MeV synchro-cyclotron at Liverpool University, the largest machine of its kind outside the United States, is now in satisfactory operation for research in nuclear physics. Sir James Chadwick initiated the project while he was Professor of Physics at Liverpool and the work was directed by Professor H. W. B. Skinner and Mr. M. J. Moore.

The machine, whose magnet poles are 56in in diameter, was built by the Metropolitan-Vickers Electrical Co., Ltd., with funds from the Department of Scientific and Industrial Research.

M. & C. Switchgear Extension

Plans have been passed by the various authorities for an extension to the Kelvinside Works of M. & C. Switchgear, Ltd., Kirkintilloch, Glasgow. This latest extension, the fifth since the company went to Kirkintilloch, provides an increase of approximately 25,000 sq ft to the existing works. The new bays embodied in this extension will provide space for an enlarged machine shop, a light fabrication department and an increased area for the assembly departments. The cost of the extension and new equipment will be in the region of £50,000.

Coal Washing Plant Order

The Fraser & Chalmers Engineering Works, Erith, of the General Electric Co., Ltd., has received a contract for a Chance coal preparation plant, to the value of £300,000, for the National Coal Board. The plant, which will be installed at Desford Colliery, will have an input of 350 tons per hour of run-of-mine coal.

British Exhibition at Copenhagen

A British trade fair and exhibition will be held at Copenhagen from 29th September to 16th October, 1955. The exhibition, which will have the full support of the British and Danish Governments, will be organized by the British Import Union of Denmark in collaboration with the Federation of British Industries. It will be held in the Tivoli Gardens and in the Forum, where the existing buildings will be supplemented by British made temporary structures. The trade exhibits will include both capital and consumer goods, ranging from heavy engineering and transport to textiles, leatherware and pottery. The Federation of British Industries is making available the services of its subsidiary company, British Overseas Fairs, Ltd., which was formed last year to run the British Trade Fair at Baghdad. Mr. D. A. Lamb, the company's exhibition organizer, will be manager of the Exhibition. A prospectus will be issued early in September, but meanwhile inquiries from prospective exhibitors should be sent to British Overseas Fairs, Ltd., 21, Tothill Street, London, S.W.1.

The stand of the Eastern Electricity Board at the recent Cambridgeshire County Show. The same exhibit will be seen at other agricultural shows in the area

Rectifiers for New Zealand

In connection with the extension of the transport system at Auckland, New Zealand, the Hackbridge and Hewittic Electric Co., Ltd., is supplying a total of 4,725 kW of rectifier equipment to the Auckland Electric Power Board. The plant comprises seven equipments each of 675 kW continuous rating. Six sets are being divided between three fixed substations whilst the seventh is a mobile equipment. This mobile unit is a complete substation mounted on a single trailer in which are housed two standard rectifier units, a high voltage o.c.b. and two d.c. feeder panels which incorporate high speed circuit breakers and auto-reclose relays. The transformer is a normal oil-filled unit and is mounted on the same six-wheeled chassis but external to the steel structure. The 6·6 kV cable can be readily connected in an air-spaced terminal box, and outgoing cables convey the d.c. output to a feeder pillar on the trolley-bus route. It can thus boost the supply wherever abnormal demands occur. Should it be sited adjacent to an existing substation, a multi-cored cable can be plugged in and full remote control would be available as for the stationary equipments. The consulting engineers are Preece, Cardew and Rider.

Colliery Year Book

The 32nd edition of the "Colliery Year Book and Coal Trades Directory," 1954, is now available from the Louis Cassier Co., Ltd., Dorset House, Stamford Street, London, S.E.1, price 30s net (31s 3d by post). In its 956 pages is presented in a convenient and reliable form the most comprehensive information of the coal mining and allied industries. While the general layout of the book and the position of the principal features remain as in the last edition, the whole work has been completely revised. The introduction in the last edition of particulars of the Continental coal mines was well received and this feature, thoroughly revised, is renewed. In addition, the bibliography of literature on coal mining has

A 675 kW Hewittic rectifier leaving the company's works for the London docks where it is being shipped to New Zealand

been extended to include books and reports published in other countries. A report on the policy and work of the Coal Utilization Council organization has been introduced for general information. For easier reference the mines index and the statistical sections are separately coloured on the fore-edge of the book. Sir Hubert Houldsworth, chairman of the National Coal Board, contributes a foreword.

"Exide" Convention

The annual "Exide" convention arranged by Chloride Batteries, Ltd., was held at Bournemouth this year, the customary banquet taking place on 24th June. Mr. A. W. Browne, the chairman of the company, and Mr. H. V. Schofield, director, arrived at the banquet in an 1898 battery-driven Krieger brougham—the company's new mascot. We reproduce a photograph of the event taken by the *Bournemouth Daily Echo*.

Messrs. A. W. Browne and H. V. Schofield arriving at the "Exide" Convention banquet

Laboratory Furnishers' Merger

The directors of Griffin & Tatlock, Ltd., and of W. & J. George & Becker, Ltd., in a joint statement issued on 29th June, announced the merging of their two organizations under the name of Griffin & George, Ltd. Pending the administrative and physical integration of the organizations, which will be a gradual process, the companies will continue to trade under their existing names and at their present addresses. The chairman of the new company is Mr. R. McKinnon Wood, O.B.E., M.A., F.R.Ae.S., and the vice-chairman is Mr. H. R. Bettinson, M.C.

Batti-Wallahs' Society

Since his visit to Moscow early this year as head of a party of industrialists, Mr. J. B. Scott, sales director of Crompton Parkinson, Ltd., has been in demand by a number of societies to give his views on Anglo-Russian trade relations and prospects. As the principal guest at last week's luncheon of the Batti-Wallahs' Society, however, the business side of the visit was forgotten and he gave an interesting account, with touches of humour, of the social side. Referring to the various works which he visited, Mr. Scott said that while the Moscow Cable Works were good, other engineering works were some years behind those in the Western Hemisphere. To those who questioned the value of such visits, he would say that anything which led to better understanding was all to the good. The interchange of people was a hope for the future.

Training Professional Engineers

Having initiated a training scheme as far back as 1902 the Metropolitan-Vickers Electrical Co., Ltd., can claim to have pioneered the systematic practical training of engineering graduates and the number of graduates trained at the Trafford Park Works now totals over 3,000. A 32-page illustrated publication entitled "The Training of the Professional Engineer," which has just been issued by the company sets out to inform final year engineering students of universities and senior technical colleges at home and overseas of the opportunities provided in the company's works for post-graduate training, both in light and heavy electrical engineering and in steam and gas turbine work.

Telephone System for "Saxonia"

Telephone facilities for the personnel of the new 22,000-ton liner, *Saxonia*, are being provided by a "Strowger" automatic telephone exchange installed by Communication Systems, Ltd. The exchange will have an ultimate capacity of 100 lines and will be mounted on an anti-vibration frame. Power will be supplied by two nickel-cadmium batteries arranged on a charge/discharge basis. Most telephones will be of desk type pattern, mounted on wall brackets, but there will also be provided a number of telephones which can be plugged in at selected points. For exposed parts of the ship portable telephones with waterproof plugs and sockets are being specially installed.

Netherlands Contract

The Netherlands Railways have placed an important contract for pumpless steel-tank rectifiers with the General Electric Co., Ltd. The order covers 13 twin-cylinder 1,224 kW at 1,530 V rectifiers and includes electronic arc-suppression equipment. This contract is the latest of a series received by the G.E.C. in the post-war period for rectifier equipment for the rehabilitation and expansion of the electrified sections of the Netherlands Railways, and brings the total quantity of fixed and mobile rectifiers supplied and on order for this administration to seventy-six cylinders with a combined rating of over 45,000 kW.

Change of Name

The name of G.M. Engineering (Ottery St. Mary), Ltd., has been changed to Ottermill Switchgear, Ltd. Drake & Gorham, Ltd., hold nearly all the issued shares.

Annual Holidays

The Telcon Works, Greenwich, and Farnborough Works, Kent, of the Telegraph Construction & Maintenance Co., Ltd., will close for the annual holidays from 16th July to 3rd August.

The works of Transformers (Watford), Ltd., will be closed from 23rd July to 7th August.

The works of M. & C. Switchgear, Ltd., will be closed from 16th July to 2nd August.

Trade Announcements

Ekco-Ensign Electric Ltd., announces the appointment of Mr. J. A. Hatto as its representative covering the county of Derbyshire and part of Nottinghamshire. He will operate from the company's East Midlands sales office at 57, Hounds Gate, Nottingham.

Mr. R. L. Moss, formerly of Santon, Ltd., has joined **Froylectric, Ltd.,** electrical wholesalers, as their Surrey representative.

Catalogues and Lists

Imperial Chemical Industries, Ltd., Millbank, London, S.W.1.—Two technical booklets on "Integron" high and low fin tubing.

Elliott Bros. (London), Ltd., Century Works, Lewisham, London, S.E.13.—Illustrated leaflet on long-scale switchboard instruments (S.1).

A. E. Cawkell, 6–7, Victory Arcade, The Broadway, Southall, Middx.—Illustrated priced leaflet on unit pulse equipment.

Gothic Electrical Supplies, Ltd., Henrietta Street, Birmingham.—Amendments and additions to the company's general catalogue.

Alar, Ltd., 3, Albemarle Street, London, W.1.—Technical data sheet on "Alar 21" aluminium casting alloy.

Metropolitan-Vickers Electrical Co., Ltd., 1–3, St. Paul's Churchyard, London, E.C.4.—Illustrated catalogue of 8ft fluorescent lamps and fittings.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 16th July:—

CHROMAPAC. No. 726,786, Class 9. Electrical apparatus for controlling the production of colour in polychrome cathode-ray tubes.—Chromatic Television Laboratories, Inc., New York, U.S.A. Address for service, c/o Leslie N. Cox, 329, High Holborn, London, W.C.1.

CASBOND. No. 727,550, Class 9. Electrical apparatus and instruments.—Plessey Co., Ltd., 56, Vicarage Lane, Ilford, Essex.

CENTRO. No. 726,593, Class 11. Electric torches, hand lamps, electric lamps and sockets for electric lamps.—S. D. Sullam, Ltd., Africa House, Kingsway, London, W.C.2.

ARISTOCRAT. No. 726,943, Class 11. Electric lighting fittings for office and domestic use.—Allen & Pope, Ltd., 14, Shacklewell Lane, Dalston, London, E.8.

Engineering in Europe

Abstracts from Foreign Technical Journals

INTERFERENCE effects between the carrier-wave communication channels on the three phases of a 400 kV transmission line (used for telecontrol, load dispatching signals, telemetering protection and service telephone) and a parallel h.f. telephone line are investigated. The problem, in itself not new, is aggravated by the fact that the apparatus used on 400 kV lines must be 10–15 times more powerful than other carrier-wave equipment used on h.v. lines up to 220 kV.

The screening effect of the other phases increases the crosstalk attenuation between the influencing loop phase-earth and the telephone line at the approaches to substations (assuming the lines to run parallel) only by about 0·13 neper. This corresponds to a reduction of the disturbing voltage in the telephone circuit by 15 per cent. According to the existing regulations, limiting the disturbing voltages to 25 μV, the lines must therefore be kept at least 1,100 m apart if the transmitting stations are at about the same "longitudinal co-ordinate" as the lines. If the stations are staggered along the lines and, say, 20 km apart, the conditions are much more favourable (on the assumption that the return currents in the neighbouring phases are equal to the current in the influencing loop phase-earth). The crosstalk attenuation then goes up by 2·33–3·8 neper, for spacings between the lines of 300 to 1,800 m, the disturbing voltages being reduced by 90–95 per cent. According to the mentioned regulations a spacing of only 330 m is then permissible.—"Influence of the H.F. Channels of a 400 kV Transmission Line on H.F. Telephone Channels," L. E. Pavlychev, *Elektrichestvo*, No. 1, pp. 26–34, 1954, in Russian.

Pressure Variation in H.V. Circuit Breakers

A pressure gauge suitable for use inside quenching chambers, etc., of circuit breakers must satisfy a number of conditions not easily combined in a single instrument, viz., independence of its readings of electric and magnetic fields and temperature rises, high natural frequency of the membrane of the pressure pick-up, independence of mechanical vibrations, smallest size of the pick-up ($\leq$ 20 mm across) and possibility of static calibration of the unit which must be adaptable to either loop or c.r. oscillographs for recording.

Two types of pick-ups, one on the capacitive and one on the inductive principle, were developed which satisfy all the mentioned conditions and have the added advantage of a very simple structure. Depending on the sensitivity, their natural frequencies are between 20 and 60 kc/s, so that even rapid pressure rises, of a frequency corresponding to about one-third of the above values, are correctly recorded.

The independence of temperature rises was obtained by a judicious choice of materials of smallest thermal expansion coefficient. The transducer and amplifier circuits are sufficiently screened to exclude all the influences of extraneous fields. The measurements made with capacitive and inductive pick-up, respectively, fully coincide. A comparison with measurements made with a piezo-electric set-up also shows full agreement with the curves obtained with the capacitive pick-up.—"Measurement of Rapidly Varying Pressures in H.V. Circuit Breakers," R. Schwetzke, *E.T.Z.* (*A.*), Vol. 75, No. 3, pp. 84–89, 1st February, 1954, in German.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

Earth Resistance Measurement

The earthing problem is still one of the most delicate questions in the design of power systems, and for obvious reasons, since the phenomena connected with the installation of earths are extremely complex; the parameters of an earth vary continuously, and not according to any predictable law because the factors influencing them are of an unpredictable nature. Soil resistance, moisture, alteration (particularly corrosion) of earth electrodes and many other factors are uncontrollable and their influences are difficult to assess.

The design of earthing systems can only be based on rather crude simplification and the initial assumptions to be made vary considerably from case to case. The attitude to the problem as a whole varies a good deal from one country to another, as is witnessed by the discrepancies in the various national regulations. This is particularly so where the basic definitions and methods of measuring the earth resistance are concerned.

The authors attempt to re-define the earth resistances of the main types of earth electrodes from first principles and to put the well-known three-point method of measuring earth resistances on a more reliable basis. The various sources of error, and error limits, of the measurements are determined and recommendations are made for improvements of the existing Italian and foreign regulations on earthing.—"Definition and Measurement of the Earth Resistance," R. Marenesi and A. Paolucci, *Elettrotecnica*, Vol. 40, No. 12, pp. 642–650, December, 1953, in Italian.

Ice Loading Intensity

The influence of the conductor diameter on the intensity of ice loading or thickness of the ice coating causes variations in the tensions of conductors of different diameter under the same weather conditions. In reality the weight of the ice coating is not proportional to the external conductor diameter, and it is incorrect to assume for theoretical purposes the thickness of the coating as constant. Several authors have mentioned the fact sometimes observed that thinner conductors mostly carry thicker ice coatings, the greater thermal capacity of thicker conductors delaying the ice formation. This, however, has an influence only on the initial phase of icing, since the thermal conductivity of ice is very low.

The most reliable observations, of the Novo-Pyatigorsk Geophysical Institute, confirmed by observations in Spain, revealed that the thickness of the coating is mostly equal for thick and thin conductors, contradicting observations made in Germany and France, in the Don Basin and elsewhere. Continuous observations by the author eventually led to the establishment of the influence of the meteorological conditions in the various climatic belts of the U.S.S.R. on the character of the ice formation on

conductors, expressed by a simple empirical equation relating the thicknesses of the ice coatings on two conductors with the conductor diameters and involving the maximum width of the lamina of the air flow from which all drops of a certain diameter are deposited on the conductor.

The width of this lamina is directly proportional to the size of the drops and to the wind speed. Now the last two quantities are variable (i.e., their averages) with the climatic conditions and, accordingly, the conductor radius may affect the thickness of the ice coating in opposite senses in different climatic belts, as shown by the author in graphs based on his observations and his empirical law. The general trend of this empirical law was also confirmed by tests on a model span and by investigations of the microstructure of ice-fogs. In the majority of cases thinner conductors will actually carry thicker ice coatings.—" The Influence of the Conductor Section on the Intensity of Ice-Loading," O. G. Vekselman, *Elektrichestvo*, No. 2, pp. 13–16, 1954, in Russian.

Wind Power Stations

The integration of wind power stations with existing and planned power grids is not only a technical possibility but also rapidly becoming a necessity since with the progress of industrialization in practically every country of the world no existing source of energy can be overlooked. The advantages and disadvantages of wind power are well known in themselves and the peculiar character of this source of energy makes it all the more necessary to combine it with more reliable and better controlled sources of the conventional kind, i.e., thermal and hydro-electric power stations.

Only such mutually assisting stations ensure the permanent availability of the required total output of any system considered. There is no lack of projects in this respect, the most interesting being at present that of the B.E.A. which already has two experimental stations in operation (in North Wales and the Orkneys, respectively). The author considers the combined load and output curves of systems incorporating " independent " and " dependent " power stations (the first type being represented by thermal power stations and hydro-electric stations with storage lakes, the second by hydro-electric stations without storage lakes, district heating stations and wind power stations), on which graphs may be based permitting the determination of the rating of the make-up power required.

The details of the design of the wind power stations and their unsolved problems are only briefly mentioned and the considerations are based on the reasonable assumption that they can, and will, be solved before long, the main purpose of the article being to prove the economic advantages of the incorporation of wind power stations with power grids.—" Wind Power Stations operating on a Power Grid," A. Kroms, *A.S.E. Bull.*, Vol. 45, No. 5, pp. 135–144, 6th March, 1954, in German.

Transmission Line Stability

Among the several possibilities of improving the static stability of long-distance transmissions, that based on the compounding of the exciters of the synchronous generators and introduction of an elastic current feedback deserves serious interest. The latter is conveniently obtained by inserting a transformer into exciter and sub-exciter circuits and may be shown to lead to an appreciable extension of the zone of stable operation of the transmission system. The limiting values of the angle δ may in this case approach the limits obtained for constant voltage at the ends of the line. The limit of the transmitted power may also be raised by using compound-wound exciters, but an appreciable increase of the limiting angles may then only be obtained if the series field is very strong.

The combination of the two above methods results in a considerable increase of the transmitted power without requiring more than the simplest type of " proportional " voltage regulators on the alternators. This renders the combined method a more economic equivalent of the methods using special and elaborate regulator types. The theory of the method, permitting of an accurate estimate of the improvements obtainable by the various means, is presented.—" The Problem of the Improvement of the Static Stability of Long-Distance Transmissions," L. Zhukov, *Elektrichestvo*, No. 1, pp. 5–11, 1954, Russian.

Cable Measuring Circuits

The measurements on communication cables refer to the main to line resistance, differences in section resistance, insulation resistance, service capacitance, leakance, loop and shunt resistances, and broken strands and may involve a wide variety of resistance ranges. Accordingly, a variety of methods has been devised each of which has its particular merits for a limited number of purposes.

These methods, for instance the Varley and Murray loop methods for earth fault detection, substitution, bridge and bridge-loop methods (Hector and Kupfmuller methods), and branching method (Graf) as alternative fault detection methods, and acoustic frequency methods for measuring fault resistances are well known in themselves, but the selection of the most appropriate of them for any case considered is not always easy.

The author describes them in a way facilitating a correct choice. Furthermore, several portable set-ups enabling the circuit for any standard method to be connected up by simple plugging are described and their operation is explained. Despite the sound basic idea of this type of equipment, not all the measuring sets on the market are sensitive enough, and if they are, they may be too heavy to be regarded as really " portable," so that they must be van-borne to be really mobile.

If the instruments used are more sensitive, they may still not be sensitive enough for certain purposes and the connected-up circuits do not permit of plugging-in precision instruments (usually laboratory types) which are required in these cases.—" Development and Improvement of Cable-Measuring Circuits for D.C. and L.F. Measurements," J. Kornfeld and R. Blahak, *O.T.F.*, Vol. 8, No. 3/4, pp. 29–36, March/April, 1954, in German.

Conducting Rubber

Resistance measurements on mixtures of conducting rubber are tricky, particularly where the considerable and only slowly reversible resistance variations caused by even slight mechanical stressing of the material are concerned. The author describes tests of a cable insulation specimen in a special set-up which showed that not only may the recovery period of such insulating materials vary from days to weeks, but also that the resistance variations may amount to multiples of the original value of the resistance. The resistance variations are irregularly distributed over the specimen. The final occurrence of a homogeneous resistance distribution is a criterion of the fullest possible recovery of the material. There is a strong temperature dependence in the recovery process.—" Electrical Measurements on Conducting Rubber," M. Zürcher and J. Lüder, *A.S.E. Bull.*, Vol. 45, No. 3, pp. 57–59, 6th February, 1954, in German.

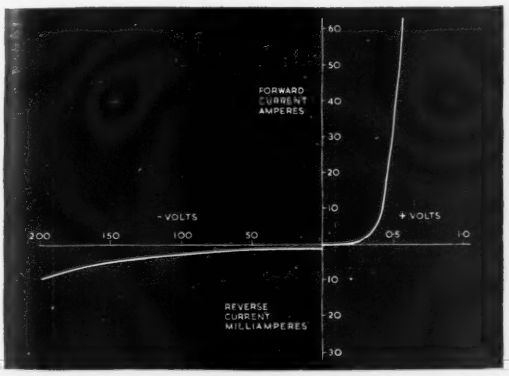
Germanium Power Rectification

New Equipment Developed by the B.T.H. Co.

SIX months ago the British Thomson-Houston Co., Ltd., put into service in its Rugby Works a germanium type rectifier rated at 300 kW, 1,100 A. This, as far as is known, is the first application of germanium on this side of the Atlantic to the problem of power rectification. A new rectifier of very high efficiency is thus entering a field normally covered by mercury vapour devices or rotating machinery.

In parallel with the development of crystal valves which the B.T.H. Research Laboratory has long since passed over to the factory for quantity production, a team of engineers and physicists combined to produce a germanium rectifier equipment capable of carrying heavy currents. This team succeeded in stepping up the value of the current obtainable from a germanium "cell" from a fraction of an ampere to 50 A. They then designed and built an equipment capable of rectifying 1,100 A at about 270 V and it was put into use in the Rugby factory almost exactly a year from the beginning of their activities. It operates on an electrolyser and has been in practically continuous service since the third week in December, 1953, on loads varying up to its maximum rating. The efficiency is 98·5 per cent and it is likely that further equipments will show an even better performance.

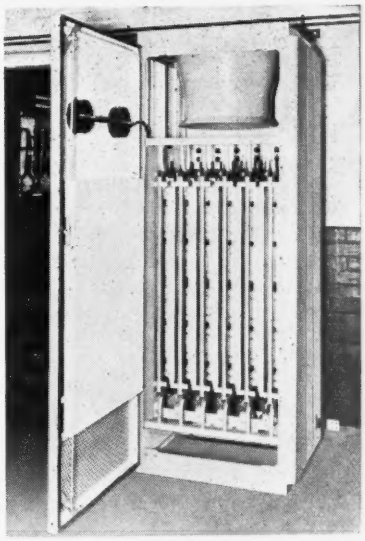
Day to day experience with the unit is being recorded, but it should be realized that before the use of germanium



Characteristics of the B.T.H. GJP rectifier at 20 deg C

on a wide scale for power rectifying devices can be accomplished, there is a great deal more work to be done. Units of new designs and different capacities must be produced at the laboratory stage, and the suitability of germanium as a rectifier for different types of service must be carefully considered. A further unit on a different type of service will be installed shortly in the B.T.H. works, and it is hoped that during the coming year two more equipments will be installed to try them out under more severe service conditions. The rectifying units for each of these will be produced in the laboratory.

The time is therefore not yet ripe for quantity production. It is, however, expected that progress during the second year of the development will be commensurate with that made during the first year, and if this expectation is realized, a means of power rectification at high efficiency will soon become available to meet industrial needs.



300 kW B.T.H. rectifier cubicle showing interior assembly of germanium cells

The current/voltage characteristic curve of a 50 A rectifier unit built in the research laboratory is shown. It will be noted that at currents of 50 A the voltage drop is less than 1 V.

Atomic Energy Authority

THE names of eight of the nine members of the United Kingdom Atomic Energy Authority which will take over the control of atomic energy developments on 1st August were announced in the House of Lords and the House of Commons last week.

Sir Edwin Plowden, formerly chief planning officer and chairman of the Economic Planning Board, will be chairman and the full-time members are Sir John Cockcroft, F.R.S., director of the Atomic Energy Research Establishment, Harwell, Sir Christopher Hinton, managing director of the Industrial Group, Department of Atomic Energy, Sir William Penney, F.R.S., director, Atomic Weapons Research Department, and Sir Donald Perrott, secretary, Department of Atomic Energy.

The part-time members are Lord Cherwell, F.R.S., Professor of Experimental Philosophy, Oxford, Sir Luke Fawcett, general secretary, Amalgamated Union of Building Trade Workers, and Mr. I. A. R. Stedeford, chairman and managing director, Tube Investments, Ltd. The salary of the chairman will be £8,500 a year, and of the full-time members £5,000, with an additional £1,000 a year each to Sir John Cockcroft, Sir Christopher Hinton and Sir William Penney in their capacity as executives of the Authority. The part-time members will receive £500 a year, except Lord Cherwell, who will, at his own request, receive no payment.

NEXT WEEK'S EVENTS

The July luncheon of the Electrical Industries Club will be held next Tuesday (13th) at the Connaught Rooms, London, W.C.2, at 12.30 for 1 p.m. The guest speaker will be Sir Frederick Handley Page, C.B.E., founder and managing director of the well-known aircraft company bearing his name. The Great Yorkshire Agricultural Show opens on Tuesday at Harrogate, and will continue on the following two days. The North-Western Branch of the Institution of Electronics is holding its annual electronics exhibition at the College of Technology, Manchester, from 14th to 20th July.

Non-Ferrous Metals Association

THE annual general meeting of the British Non-Ferrous Metals Association was held in Birmingham on 1st July when the following officers were elected for the coming year:—President, Mr. W. F. Brazener, J.P.; vice-presidents, Messrs. H. C. Gibbins, B.A., and C. E. Prosser; treasurer, Mr. A. L. Johnson, M.A.

In the course of his annual report, Mr. H. E. Jackson, the retiring president, said that during the first eight months of 1953 the output of semi-finished products of copper and copper-base alloys dropped steadily each month. From September the situation began to improve, but the average monthly figures for the whole of 1953 were well below those for 1952. Since September last the average output had been something like 45,000 tons per month.

On the export side it was noticeable in the early months of last year that there was a continued decline. Since September, however, business had picked up steadily, although we were still only exporting about half of the tonnage exported only a few years ago during the pre-Korea period.

Referring to the freeing of the metal market for copper and the problems which had followed, Mr. Jackson said that the price of copper remained high. The selling price before decontrol was £252 per ton. With the re-opening of the London Metal Exchange on 5th August, the price fell sharply to £216 per ton, but then rose rapidly until towards the end of October it reached £247 10s per ton. Further falls and rises had occurred and during the months of May and June the price was around £240 per ton.

One of the Federation's main preoccupations during the year had been the inquiry by the Monopolies and Restrictive Practices Commission into the supply and export of certain semi-manufactures of copper and copper-based alloys. It was to be expected that the Commission's reports would be followed by discussion before any action was taken to put its recommendations into force. In practice, there had been no real discussion by Parliament or the general public of the immense issues raised; nor had industry and commerce made any attempt so far to formulate their collective views. In consequence the Monopolies Commission was becoming the final arbiter as to where public interest lay—a function which went far beyond the competence of any small group of individuals.

The function of any Commission in such matters should be to investigate the facts and to elucidate the issues. When reports were available covering a sufficiently wide front, then consideration should be given to general remedies for any abuses which might be shown to exist. He would like this to lead up to a kind of " charter for good trading " which could be understood and accepted by all. In the meantime individual industries should not be singled out for special treatment and should not be subjected to special orders or threat of orders in respect of customs known to be widespread in industry and commerce.

Welding Research

IN the annual report of the British Welding Research Association for 1953–54 an increase in membership is again recorded, with the income of the Association now in excess of £100,000. As a result of a special grant the Association has been able to purchase in the United States a Sciaky three-phase spot welding machine and a Baldwin-Tate-Emery 400,000 lb universal testing machine. This additional equipment will appreciably augment the facilities available at the research station at Abington, and will be displayed at the annual " open day " there on 14th July.

Work on the weldability of low-alloy structural steels has led to the production of steels having a 0·3 per cent proof stress of up to 35 tons/sq in when using low-hydrogen electrodes compared with 25 tons/sq in for the best acceptable alloy weldable with rutile electrodes. Dilution of the weld by the parent plate has been found to be the cause of cracking in welding H.10 bridge deck units with A1–5 per cent Si electrodes, and a cracking test has been developed to permit comparison of different electrodes when welding this alloy.

High strength, heat-treatable aluminium alloys are being examined for suitable welding techniques. Welds have already been produced with higher strengths than those obtainable from commercially available filler alloys. A fundamental investigation of the self-adjusting characteristics of high current density metal-arcs has shown that the self-adjustment effect increases rapidly as the open circuit voltage approaches the arc voltage. The ideal power source can, therefore, be substantially different from that used with normal metal-arc welding.

A code of practice has been published on the projection welding of mild steel (T.30) and a revised code has been issued on the spot welding of low carbon steel (T.21A). A committee has been set up to examine the testing of resistance welds, since there is a great lack of uniformity in test methods used for evaluating the quality of resistance welds.

Fatigue tests have been completed on several different designs of thin-gauge box section girders when loaded about both major and minor axes. These sections are of the type used for motor-car chassis, and tests are now in progress using alternating torsion. This work will undoubtedly influence the design of chassis members as there is shown to be an appreciable difference in the fatigue limit depending on the method of welding used.

Brittle fracture of welded structures continues to receive attention. Docherty's classic experiment on " size effect " in which, with successively smaller notched specimens, failure suddenly changes from brittle to ductile, have been repeated and can be explained. The velocity of propagating brittle cracks has been calculated from theory (for the first time) and corresponds with the facts. Brittle fracture tests on wide plates bearing a close resemblance to practical conditions are in course of preparation.

Bhakra-Nangal Project

From Our Indian Correspondent

ALTHOUGH the 680ft high Bhakra dam on the River Sutlej is still to be built, it is expected that power from the Nangal dam, a few miles downstream of Bhakra will be made available to consumers in the Punjab and Delhi by the beginning of next year, if not earlier. The latest progress report refers to the recent advances made in construction, including the completion of the channel which, taking off just above the Nangal dam, will feed the two power stations about 12 miles downstream and will also serve the two main irrigation canals. The Nangal channel is described as the biggest artificial channel in the world. Its normal cross-section is 92ft at the bottom with sides sloping out at 1·25 to 1 over an average depth of 20ft. It is 39·6 miles long and is lined throughout with concrete. Mr. Nehru, the Prime Minister, is performing the official inauguration ceremony this week.

The two power stations, each with an initial capacity of 48,000 kW consisting of two 24,000 kW sets, are approaching completion. A lot of controversy is still going on about the size of the stations in an area with little prospect of load in the near future, but the Government's policy appears to be to " let the load take care of itself." The Bhakra dam itself will have a 600,000 kW power station, a capacity that is almost a third of the *total* installed capacity in the country as a whole, and it is still not clear whether the Government will go ahead with it. But a start on the dam itself will probably be made this year for which the two diversion tunnels of 50ft diameter are just about to be completed. Work on the transmission lines is lagging behind but it is hoped that Delhi may receive power some time next year.

Generally speaking, enough progress has now been made on this £120 million project, which two years ago seemed to be bogged down owing to technical and financial difficulties, to warrant hopes that it will at last become a reality.

INSTALLATION INSPECTION

Divided Views Hold Up Progress

From an Industrial Correspondent

An article, "Better Installations," published in the *Electrical Review* of 18th April, 1952, reviewed the position of electrical regulations, registration and inspection since the publication of the first edition of the I.E.E. Wiring Regulations over 70 years ago to the establishment of the Organizing Committee for the National Inspection Council for Electrical Installation Contracting, following the nationalization of the electricity supply industry in 1948.

At the time that the article was written the results of the Organizing Committee's deliberations had not been made public, nor have they yet been. From brief reports and from information to be gleaned from various sources, however, it was to be inferred that the Committee was making slow progress in reaching agreed proposals. Set up in November, 1949, on the initiative of the British Electricity Authority, the fourth report of the Authority to the year ended 31st March, 1952, could only inform us that the Committee had "reached agreement on their recommendations and their draft report was submitted for consideration to the bodies represented on the Committee."

The reference in the following year's report was just as terse and brief, but it confirmed the suspicion that there were dissenting bodies on the Committee strongly opposed to the draft report and the scheme for a National Inspection Council. After stating that the draft report had been circulated for consideration by the organizations represented on the Committee, the B.E.A.'s annual report for the year 1952–53 made the significant admission that: "Submissions made by two of these organizations embody fundamental changes in the proposed character and functions of the Council (National Inspection Council for Electrical Installation Contracting), and until this difficulty is resolved progress is halted."

Independent Scheme Considered

It is now known that towards the end of 1952, the Electrical Contractors' Association was moving away from its association with the Organizing Committee towards an independent inspection scheme of its own. According to the report of the executive council to the recent annual delegate conference of the Electrical Trades Union, as circulated to the Press, the E.C.A. (through its labour organization, the National Federated Electrical Association) had submitted a draft report to the Union embodying a scheme for the setting up of an independent inspection council to inspect all electrical installation work whoever may have carried it out and whether new or existing work.

The E.C.A.'s scheme was the subject of consideration by the National Joint Industrial Council for the Electrical Contracting Industry in February, 1953. At a meeting of the Standing Committee of the Council, the E.C.A. stated that it "was becoming increasingly concerned at the extent to which shoddy materials and apparatus were being manufactured, sold and installed." Its "proposal was of direct interest to the N.J.I.C. because the object was to raise the standard of installation work, and the alternative scheme put forward by the E.C.A. was a tangible contribution to achieve this end without the difficulties inherent in the original scheme of the Organizing Committee of the National Inspection Council"—a clear enough statement that the E.C.A. was dissatisfied with the scheme proposed by the Organizing Committee.

Later in the report of the executive council of the E.T.U. some details were given of the alternative scheme of the E.C.A. "It was proposed," the E.T.U. report stated, "that the council (i.e., inspection council) should consist of representatives of substantial consumers of electricity, but its technical background should be supplied by the E.C.A., the E.T.U. and the B.E.A."

Powers of Enforcement

One criticism by the E.T.U. of the E.C.A.'s scheme was "the difficulty of getting the present Government, or any government, to approve legislation which would confer upon the proposed independent inspection council the required statutory powers." To this objection, the E.C.A. replied "that there was no need for legislation because Section 60 of the Electricity Act, 1947, conferred upon the Minister of Fuel and Power the right to make any regulations which he might think necessary for the purpose of protecting the public from any dangers inherent in the use of electricity."

To the question: "Did the E.C.A. consider that the proposed council would have the right of enforcement, on the supposition that the Minister agreed to make regulations?" the E.C.A.'s answer was a definite affirmative. The E.C.A. also felt that, as Electricity Boards had statutory powers to refuse to connect installations which they considered to be unsafe, then they had the same power to refuse to connect if a statutory body declared an installation to be unsafe.

That the E.C.A.'s attitude towards a voluntary scheme of inspection was hardening into one of resolute opposition was made clear when the subject was again discussed by the N.J.I.C. towards the end of March, 1953. It was noted that, while the E.T.U. had decided to support the scheme of the Organizing Committee, it was of the opinion that statutory control was essential, and that anything falling short of that failed to meet the case. The E.C.A. appreciated this point of view, and again reaffirmed its opinion that it would be practicable to formulate a scheme based upon existing statutory powers.

As to the suggestion that inspection might be brought within the jurisdiction of a Government Department, the E.C.A. thought this would mean duplication of the work of the supply authorities. As the Electricity Boards were arbitrators in their own cause, the E.C.A. was of the opinion that "a more simple solution might be for the responsibility of inspection to be taken over by local authorities, in a similar manner to building work, provided that the authorities concerned employed qualified inspectors and worked to a standard code of practice."

The N.J.I.C. then went on to record that "the views of the E.C.A. and the E.T.U. were closely associated, in so far as the following three points were concerned:

"(1) All voluntary schemes of inspection having failed, the inspection of electrical installation work must be

subject to statutory control. (2) The question of what form the inspection should take. (3) The views were not final, but the aim was to achieve an appropriate measure of statutory control."

Before the meeting closed, however, the Union and the Association were to take to themselves prerogatives that could be challenged by other bodies. The E.C.A. stated that it had recently met the B.E.A. with regard to the Organizing Committee's proposed inspection council. In reply to a question by the E.T.U. as to whether a further meeting might be arranged, the E.C.A. replied that " all the constituent bodies of the Committee of the National Inspection Council had expressed their views. As the criterion of the entire matter was the standard of contracting work, it was obvious that the E.C.A. and the E.T.U. were the organizations vitally concerned and their joint views could be put forward as the voice of the industry "—a view in which Electricity Boards with their own contracting departments would not be expected to acquiesce.

There is no public record of any further meetings between the E.C.A. and the E.T.U. called to consider an independent inspection council. The position, however, would appear to have been complicated by decisions of the recent annual delegate conference of the E.T.U. As the *Electrical Review* has already recorded, the conference, against the wishes of the executive council, rejected a motion for the establishment of an independent inspection council with statutory powers of enforcement. But while the executive council supported the motion for an inspection council, it opposed a further motion which urged it to take action to have all electrical contractors and operatives registered by statute, and to ensure that only those so registered should be allowed to do contracting work. The motion was defeated, and the defeat of both motions has apparently left the E.T.U. without any policy whatsoever, either on a national inspection council or on compulsory registration.

The E.C.A. on the other hand wants both an inspection council, with statutory powers of enforcement, and the compulsory registration of electrical contractors and operatives. Mr. W. T. Trace, in his presidential address to the Association last year, said he held the view, which he declared was shared by the vast majority, " that if, in the interest of the public, compulsory registration of the electrical contractor and the operative is desirable, there is nothing which stands in the way of its achievement." And he added: " During the past twelve months further examination has been given to various proposals which have been put forward in the direction of voluntary registration, but it is of some significance to note that each of the three interests in the electrical contracting industry have made it clear beyond any measure of doubt that in the light of their unique experience, they are satisfied that nothing which does not possess a proper element of statutory control will have the desired effect."

The decisions of the recent E.T.U. annual conference would seem to have disturbed somewhat this harmony of view, and it is far from certain that it is shared by other interested bodies. Nor does it appear, from available evidence, that there has been any fundamental change in the attitude of the Institution of Electrical Engineers, when in 1944 it published its report on " Electricity Supply, Distribution and Installation." In the section dealing with installation, the Institution rejected the proposal of the National Committee on Statutory Wiring Regulations and Registration for the compulsory registration of electrical contractors and operatives.

How far the Organizing Committee is prepared to push its proposals for a voluntary scheme is not known. But decision on the proposals would seem to rest largely with the B.E.A. and the Electricity Boards, the largest and most powerful bodies represented on the Committee. On the other hand, the Electrical Contractors' Association has continued the movement it helped to launch in 1937 for statutory registration and control, but this time it has so far only one ally, the Electrical Trades Union.

The divided opinions within the industry on the subject are not a good augury for the success of either a statutory scheme or a voluntary one.

ELECTRICITY IN QATAR

A DIESEL power station for the public electricity supply of Doha, capital of Qatar, on the Persian Gulf was recently opened by the ruler, Sheikh Ali bin Abdulla bin Jasim Al-Thani. This marks the completion of the first stage of a scheme for the provision of power generation and substation equipment under a contract signed by the Qatar State Electricity Department jointly with Brush Export, Ltd., and the British Insulated Callender's Construction Co., Ltd. At the opening ceremony Mr. Rex Bate (director of Brush Export, Ltd.) read an address to the Sheikh. Others present included the State engineer (Mr. H. T. Hale) and the electrical engineer and manager (Mr. B. L. Burgess).

Brush Export, Ltd., as main contractors for the complete diesel power station, have been responsible for all civil engineering work, the complete lighting system in the power station, workshops and offices, and all the station cabling and earthing. The generating sets installed are two 4-cylinder and two 8-cylinder " National " diesel engines driving Brush alternators of 190 kW and 390 kW respectively. Switching is carried out at 3·3 kV on a Brush 13-panel VA5 type switchboard. Ring main feeders control the supply to the town's network. For supplying the station ancillary equipment, two Brush step-down 100 kVA transformers have been installed, feeding a Brush 9-panel, 415 V, three-phase, four-wire switchboard. The main cabling has been carried out in p.i.l.c.s.w.a. cable and Pyrotenax m.i.c.c. cable has been used for the power and lighting circuits. In view of the shortage of suitable water, Fluor " Fin-Fan " air-cooled heat-exchangers of the forced draft type have been installed, using distilled water in a closed cooling system.

Before construction of the main station began, two McLaren/Brush 70 kW, 415 V diesel units were installed in a temporary building. These have now been transferred to Raiyan to light the palace of the father of the ruler.

The supply, installation and commissioning of the e.h.v. and l.v. distribution system have been carried out under a separate contract by the British Insulated Callender's Construction Co., Ltd., Brush Export, Ltd., supplying all the h.v. and l.v. switchgear and transformers for this scheme. Three main substations have been installed with a total of five 100 kVA step-down transformers.

Extensions to the power station under the second phase are now in hand, comprising three " National " eight-cylinder pressure-charged diesel engines driving Brush alternators each giving a site output of 540 kW, with Fluor " Fin-Fan " coolers and all other ancillary equipment. The distribution network in the town is also being extended and a further twelve substations are being built, all of which will be equipped with Brush h.v. and l.v. switchgear and transformers.

The consulting engineers for the complete electrification of Doha are Messrs. Preece, Cardew and Rider.

Farm Installations

Earthing Aspects of the New Codes of Practice

By T. C. GILBERT, M.I.E.E.

THE advent of new Codes of Practice must always be a matter of considerable interest to the utilization side of the industry, but few will excite more than that rather massive document CP 325 (1953), "Farm and Horticultural Electrical Installations." Taken all in all, this is a most satisfactory code, and meets all requirements on farms, etc., with suitable recommendations that leave little to be desired.

Unfortunately, no code can ever be completely up-to-date, as the lapse of time between the Committee's deliberations and the final publication of the document appears to be of considerable length—in this case about five years. It therefore follows that practices introduced after the preparation of the code has begun, or even before if the Committee considers that sufficient practical experience with any practice or method has not been gained, will probably receive no mention in the code. Only in this way can the complete omission of any reference to non-metallic conduits in the code be explained, as this particular method of wiring is well on the way to establishing itself as an ideal system of wiring for farm and horticultural installations.

Industrial Standards Required

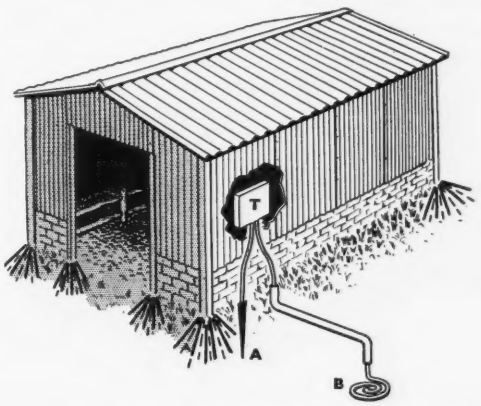
As the code points out, in para. O.305, farm wiring and equipment may be required to withstand mechanical damage, damp, steam, ammonia fumes, lactic acid and milk fats, coke and oil fumes, sulphur fumes, sunlight and heat. Equipment should therefore possess in a substantial degree the qualities regarded as essential in industrial installations, but usually it is not possible to make use of such costly materials. The use of metal conduits is deprecated, but where their use is unavoidable—the writer can visualize no such situations, in view of the availability of strong, tough, non-metallic conduits—certain precautions are to be observed. The requirement for drainage of metal conduits contained in the original draft for comment appears to have been dropped in the final code, probably because of the two schools of thought on this practice.

At first sight, it would appear that in the past a great deal of metal conduit has been unnecessarily used in farm and similar installations, but some engineers, although well acquainted with the drawbacks of this particular system, have defended its use on the following grounds. They say that the ordinary farm wiring systems, utilizing t.r.s., p.v.c., or p.c.p. sheathed cable assemblies with numerous junction boxes require too much exposure of the conductor and its immediate insulation at every junction. With cracking or breakage of the box both insulation and metal conductor are immediately exposed to the ingress of moisture or chemical fumes, with liability to early breakdown. With conduit systems, such exposure takes place at a greatly reduced number of points, usually only at accessories and lighting fittings, and the risk is correspondingly reduced.

If this is a valid point, then the case for non-metallic conduit becomes even stronger. Should a moulded junction box associated with this system become damaged no actual conductor is exposed, and fire or breakdown is minimized. I would like to have seen a requirement for non-inflammable wiring material more strongly stressed in the code, in view of the tinder-like condition of much old timber in farm buildings, but beyond mentioning the need for care with blow-lamps, etc., the code rather skates over this matter in recommending rubber insulation for cables, although with protective sheathing in some cases. The use of p.v.c. compound conduits with p.v.c. insulated cables would render the wiring installation completely non-inflammable, would greatly reinforce insulation, and be absolutely proof against all forms of corrosion, water, sunlight, petrol and oil, and be non-ageing. Also, long complete lengths of conduit could be run underground between farm buildings, thus eliminating costly and vulnerable overhead lines, and this necessitates some careful attention in the code.

The code recommendations with regard to the all-important matter of earth-leakage protection are wholly admirable, but I am sorry to find the omission in the final code of a most telling point contained in the draft-for-comment issue—"The aim is, first, to prevent any leakage of electricity to non-current-carrying portions of apparatus, buildings, etc., and, secondly, to ensure that, if any such leakage occurs, the faulty circuit is immediately and automatically disconnected." This is really putting first things first, and might be thought to be inherent in the final code in view of its general recommendations, but I feel that the point cannot be too often emphasized; as it stands, the code is content to deal with the second point in detail, leaving the important first point to be understood. Insulation, plus the reinforcement of insulation, is the most effective form of leakage protection.

I would also like to have seen an elaboration of para. O.311 (f), in which the following appears—"a direct connection to earth may be made at each motor or other appliance through an earth-leakage circuit breaker . . .



Local electrodes should be spaced well away from metal buildings

T – Earth leakage circuit breaker. A – Local electrode too close to building footings. B – Simple remote electrode of galvanized iron wire in flexible non-metallic conduit

the earth electrode should be installed outside the resistance area of any other earth electrode, or metal acting as such and liable to form a parallel path to earth." In the past, many accidents to livestock and farm hands have occurred by reason of metal or metal-framed buildings becoming alive, and normally the footings of such buildings might not be considered as an alternative electrode by the installer of the leakage trip. They can act as such, however, in the event of fault, and it is necessary to ensure that local electrodes of the type visualized in the code are spaced well away from all such buildings, or they will fall into the gradient formed at the base of the building, as shown in the sketch on the previous page.

The matter of possible shunting of the leakage trip coil by an alternative path to earth is a vexed one, but can very often be overcome with attention to the *alternative* path. For instance, I was recently informed of a case in which an earth-leakage circuit breaker was installed for the protection of a motor connected to a water pump, and it was found necessary to drive the trip electrode some 75 yards away before it could be made to work on direct earth fault. It was later found that if the suction pipe, which passed down through the ground for a considerable distance before emerging into the well, were excavated to a depth of about six feet, with half-round sections of stoneware piping placed round the pipe before reinstatement of the ground, the trip electrode could be placed within 10ft of the motor with certain operation.

In spite of what has been said in the foregoing paragraph I deprecate the sweeping statement made in para. O.311 of the code, which, in recommending the use of a differential-current-operated leakage protection device, says—" a device operating on this principle has the advantage that it cannot be rendered inoperative, as might be the case with (f) of this clause (the voltage-operated earth-leakage trip) in the event of the leakage current following a number of parallel paths." In the great majority of cases it does not signify in the least where the leakage *current* goes, as the voltage-operated device concerns itself only with the leakage *potential* set up on protected metal casings in relation to earth; no potential, no danger —dangerous potential, immediate operation! Fortuitous earth contacts fall under very many headings, but they are rarely in the same category as alternative electrodes, although it must be agreed that under the conditions visualized in the preceding paragraph some attention to the point is necessary.

Differentially Operated Device

I do not like the differential-current-operated device, and would not of free choice install it on a farm. The reasons are, briefly: an unsuspected leakage on a neutral conductor in the installation renders the device inoperative; the so-called test key does not check the earth connection, surely the most vulnerable part of the protective circuit, but only the circuit breaker mechanism; the device requires both poles of the supply for operation, and the farm hand who has pulled down the neutral line with his ladder—the neutral is usually the lower—has effectively put it out of action, and the same effect is likely with a short-circuit on a building service remote from the substation; the device is too costly for installation in the numbers required for complete leakage protection. It should be pointed out that this recommendation for differentially operated devices did not appear in the draft circulated for comment, or these remarks might have been offered at that time.

In the final result, however, all these points amount to no more than minor criticisms of an excellent and acceptable Code of Practice, reflecting great credit on all responsible for its preparation. All that can be asked for is a short addendum whereby the use of our non-metallic conduits may be rendered legitimate, as it were, in the drive for more complete and efficient farm and horticultural electrical installations. I cannot think that complete absence of reference to them indicates disapproval on the part of the compilers, seeing that this one system is capable of answering *all* the questions regarding suitability for the job.

Caravan Code

The second code, although not described as such, is Recommended Practice for Electrical Installations in Caravans, resulting from a 1952 conference with a view to settling some differences of opinion regarding the application of the Wiring Regulations to trailer caravan installations utilizing public or private supplies at about 250 volts. Whilst not departing in major points from the full Regulation requirements the code serves to emphasize certain provisions particularly applicable to installations of this kind.

The writer has little comment to offer on the general provisions, although some of these need a little study. The earthing clauses, however, appear at first sight to be somewhat clumsy and complicated, but here again all factors must be taken into account before controversial points are raised. The apparent creation of three spheres of differing potential due to leakage—connected equipment, trailer chassis and the ground—seems unnecessary, and may introduce difficulties in practice; the writer is at a complete loss, however, to understand the reference in clause 6.6 to " a leakage current not exceeding 40 milliamperes where earth leakage circuit breakers are used." Why are not the useful and popular devices utilizing tripping currents between 60 and 80 milliamperes considered suitable to this particular application?

Experience in the past has shown that attempts to limit tripping currents to unnecessarily low values has resulted in the provision of unduly fragile wire windings on tripping coils, with consequent unreliability. Small induced secondaries from nearby lightning strokes have a most disruptive effect upon mechanically weak windings, splitting out the end layers; the only answer has been the employment of as heavy a gauge of wire for coils as the efficient design of the circuit breaker permits, with operation within the limits set by B.S. 842 : 1939, which, by the way, is not mentioned in the list of British Standard Specifications in Section 8.

Caravans are used mainly through the summer months, with supply to the sites by overhead lines; with the inclusion of an earthing conductor in these lines the stage is all set for maximum disturbance from lightning, and no weakening of the tripping coil should be contemplated. The writer would suggest that reconsideration of this requirement is desirable, as it can, in his opinion, serve no useful purpose, whilst cutting out from immediate application most of those useful devices already constructed in accordance with the provisions of B.S. 842, and available. Surely the actual tripping current is of little moment provided that the visualized voltage limitation and speed of operation of the specification are ensured; if this does not consider such artificial limitation of tripping currents necessary why is it called for in these recommendations?

There may be some logical explanation of this particular requirement, but it eludes me at the moment; it is far too reminiscent of that old requirement " with a leakage current not exceeding 30 milliamperes " which had such adverse effect upon the development of reliable earth-leakage circuit breakers, and was abandoned some years ago in the Wiring Regulations in favour of concentration upon voltage operation.

WIND TUNNEL DRIVE

Equipment for de Havilland Aircraft Co.

A NEW wind tunnel for testing scale-model aircraft has recently been completed for the de Havilland Aircraft Co. at Hatfield Aerodrome, and the electrical equipment for driving the fan has been supplied by the British Thomson-Houston Co., Ltd. The tunnel has a closed air circuit and the speed of the air stream is variable up to 250 ft/sec maximum. It can be maintained to within ± 0·15 per cent of this speed by electronic control.

All the heavy electrical equipment is housed in a motor room close to the tunnel, the fan inside the tunnel being directly coupled to the driving motor by a 28ft long shaft. The fan-driving motor is a d.c. machine rated at 450 h.p. continuously with a two-hour rating of 500 h.p., 460 V at 800 r.p.m. Speed variation over a 4 : 1 range is by Ward-Leonard control. Provision has been made for stopping the motor by dynamic braking in case of emergency and under such conditions it can be brought to rest from full speed in about 5 sec.

The motor is supplied from a three-unit motor-generator set consisting of a 604 h.p., 2,870 V, three-phase 50 c/s slip-ring motor driving a 400 kW, 460 V d.c. generator, and a 3 kW, 250 V exciter. Starting equipment in the motor room for the m.g. set includes a hand-operated 400 A, air insulated, vertical-plugging, metalclad oil circuit breaker, and a liquid starter. Also in the motor room are the main contactor panel and the electronic speed regulator.

Once the m.g. set has been started from the motor room, all other operations for controlling the fan motor can be carried out from a control desk near the working section of the wind tunnel. However, selector switches fitted on the electronic control panel enable such operations to be effected from the motor room, when required.

In addition to the aerodynamic controls on the control desk, there are various push-buttons, indicator lights, a speed control rheostat for the fan motor, voltmeter, ammeter, and a revolution indicator. There are also "coarse" and "fine" rheostats for the generator field so that the fan motor speed can be controlled manually from the desk.

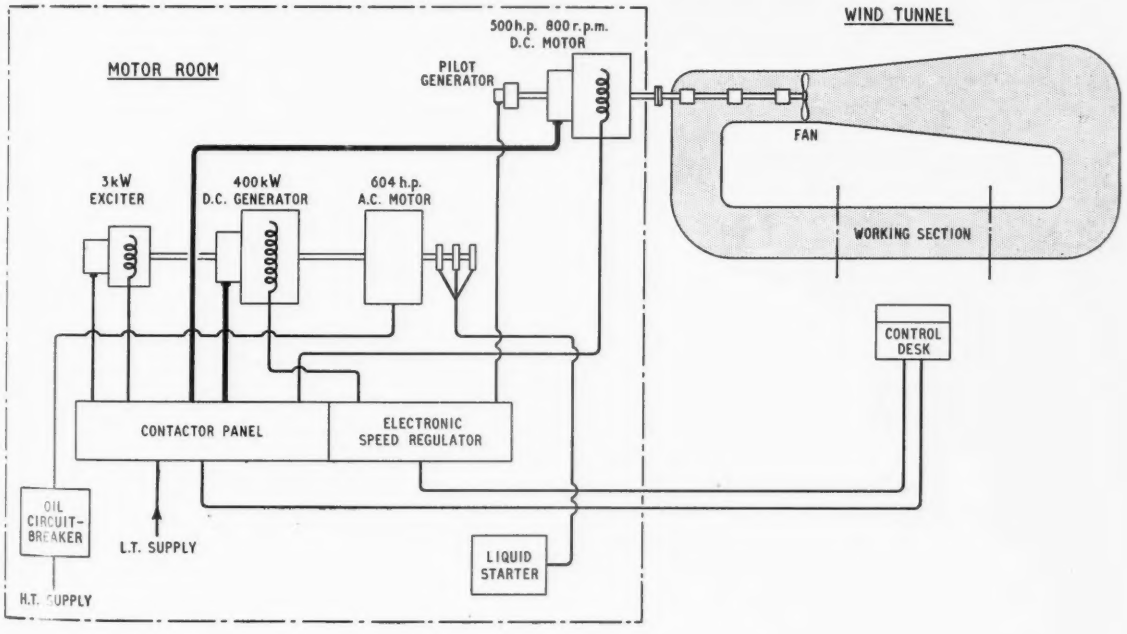
The operation of the electronic speed regulator depends on the principle of balancing two small signal voltages within very fine limits and, in this way, the speed of the fan motor is held at a constant value set on the speed control rheostat. One of these signal voltages is obtained from the speed control rheostat itself (the voltage being proportional to the speed at which it is desired to run the fan motor) and the other is obtained from a permanent-magnet pilot generator coupled to the fan motor, which provides a voltage proportional to the actual speed of the motor. Any departure in actual speed from the pre-set value upsets the balance between the two voltages, and the out-of-balance voltage (acting through the amplifier) causes a change in the excitation of the generator field in such a way as to minimize the error in speed.

Sufficient amplification is available to ensure that an adequate range of excitation is available to overcome all likely disturbing factors, resulting in only a negligible change in speed and consequent out-of-balance voltage. Protective devices on the panel include current-limiting circuits to keep the armature current to a safe value during acceleration and retardation by exerting an over-riding control of the thyratron field-rectifier voltage. Stabilizing feedback circuits are also included to prevent "hunting."

World Power Conference

Statistical Year-Book, No. 7, of the World Power Conference (edited by Frederick Brown and published by Lund, Humphries & Co., Ltd., 12, Bedford Square, at £2) contains particulars, on a comparable basis, for 1950–52, and where available for 1953 also, relating to all significant forms of power in the world, except in "iron-curtain countries" for which the data obtainable are incomplete. The statistics are compiled on a standard basis, enabling comparisons to be drawn between different countries.

Basic arrangement of B.T.H. wind-tunnel drive for de Havilland Aircraft Co.



AUSTRALIAN ELECTRICAL IMPORTS

Analysis of 1952-53 *Figures*

PRELIMINARY statistics for 1952–53 of Australia's import and export trade, showing the principal countries of supply and destination, have been issued by the Commonwealth Government. The import figures for electrical goods reflect the cut which had to be made in Australia's external purchases. The total value was £A26,656,000 compared with £A34,947,000 in 1951–52. The chief items with notes of increase or decrease on the previous year are given below, with the main supplying countries, which revealed little change apart from a falling-off in imports of power plant from Switzerland. The share of the United Kingdom in the trade was well maintained.

Class of Goods	1952–53 £A (000)	Inc.or dec. on 1951–52 £A (000)
A.c. generator sets ..	165	— 5
From U.K. ..	159	+ 113
„ *U.S.A.* ..	—	— 60
„ *Italy* ..	—	— 28
D.c. generator sets ..	186	+ 109
From U.K. ..	141	+ 74
„ *U.S.A.* ..	39	+ 33
Alternators for turbines	1,011*	+ 398
Other alternators ..	694	— 942
From U.K. ..	606	— 872
Other generators ..	191	— 28
Motors under 1 h.p. except as parts of machines	690	— 1,099
From U.K. ..	591	— 958
„ *U.S.A.* ..	23	— 13
„ *Canada* ..	51	— 89
Motors 1 h.p. and over, a.c. induction (non-commutator type)	2,353	+ 220
From U.K. ..	1,471	— 107
„ *U.S.A.* ..	804	+ 345
„ *Western Germany*	42	+ 14
Ditto, other ..	185	— 85
D.c. motors not for lifts or traction ..	133	— 74
From U.K. ..	92	— 92
„ *U.S.A.* ..	35	+ 15
Electric stoves, cookers and the like ..	99	— 1,751
Telegraph and telephone cable and wire, l.c. and l.a., p.i.	60*	— 277
Ditto (other insulated)	116*	— 1
Other covered telegraph and telephone cable and wire ..	210*	+ 6
Light and power cable, l.c. and l.a., p.i. ..	1,951	+ 824
From U.K. ..	1,944	+ 834
Ditto, otherwise insulated	429*	+ 123
Other covered light and power cable ..	424*	— 20
Enamelled wire (not otherwise covered)	86	+ 20
Lamps, filament, automobile	93	— 104
From U.K. ..	44	— 74
„ *Netherlands*	37	— 22
Lamps under 20 V, flashlight	21	— 11
Other lamps under 20 V	37	— 79
Lamps 20 V and over, gas-filled	27	— 50
Lamps 20 V and over, m.f.	11	— 32
Fluorescent tubes ..	51*	— 308
Radiators, toasters and kettles	21	— 165
Measuring and recording instruments ..	311	— 132
From U.K. ..	223	— 139
„ *U.S.A.* ..	37	+ 6
Telegraph instruments	39	— 91
From U.K. ..	21	— 19
Telephones and parts	272*	— 202
Telephone switchboards, automatic..	285	— 933
From U.K. ..	284	— 929
Telephone and telegraph switchboards and appliances, n.e.i.	1,434	— 949
From U.K. ..	1,137	— 895
„ *U.S.A.* ..	137	— 300
„ *Canada* ..	184	+ 184
Regulating, controlling and starting apparatus, including distribution boards and switchboards, n.e.i.	1,054	— 242
From U.K. ..	932	— 175
„ *U.S.A.* ..	63	— 79
„ *West Germany* ..	30	+ 13
Radio valves ..	366	— 148
Radio receiving sets..	44	— 119
Transmitting sets ..	203	+ 187

* Wholly or mainly from U.K.

INDIAN IMPORT TRADE

IMPORTS of electrical goods by India during the financial year ended March, 1953, totalled Rs. 30,96,27,000, an increase of about 15 per cent on 1951–52; the share of the United Kingdom was Rs. 20,70,95,000, an advance of approximately 22 per cent, while that of the United States was Rs. 3,66,91,000 compared with Rs. 3,59,62,000 during the preceding twelve months. Values of the principal items are shown in the accompanying table. It will be seen that the improvement in trade in wires and cables, telegraph and telephone instruments and apparatus and most electrical machinery was offset by declines in business in much of the lighter materials.

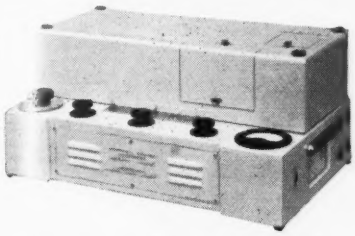
Class of Equipment	1952-53 Rs.(000)	Inc. or dec. on 1951-52 Rs. (000)
Fans and parts ..	4,46	— 1,05
From U.K. ..	1,58	— 1,61
„ *U.S.A.* ..	12	+ 5
Wires and cables, not telegraph or telephone, rubber insulated	78,04*	+ 26,08
Ditto, other insulations	6,07,61	+3,57,21
From U.K. ..	5,59,23	+3,14,19
„ *U.S.A.* ..	3.64	+ 2,65
Telegraph and telephone wires and cables	10,17	+ 6,71
From U.K. ..	6,26	+ 3,61
„ *Japan* ..	2,54	+ 2,20
Telegraph and telephone instruments and apparatus ..	38,51	+ 11,45
From U.K. ..	29,01	+ 5,14
Electric lamps ..	3,89	— 2,99
From U.K. ..	2,82	+ 7
„ *U.S.A.* ..	1	— 1,74
Vacuum electric lamps	1,60	+ 1,12
Electric lamps for automobiles ..	19,81	— 12,24
From U.K. ..	2,49	— 8,68
„ *U.S.A.* ..	12,67	+ 2,78
Electric bulbs for torches	18,99	— 8,04
From Hong Kong	6,53	+ 1,88
„ *U.S.A.* ..	2,05	— 9,88
Other electric lamps..	28,81	+ 11,33
Radio apparatus ..	1,49,91	— 56,99
From U.K. ..	90,83	— 43,83
„ *U.S.A.* ..	18,87	— 8,08
Batteries	16,84	— 7,42
From U.K. ..	11,97	— 3,58
„ *U.S.A.* ..	3,47	— 2,90
Accumulators and parts	29,61	— 9,18
From U.K. ..	27,10	— 7,09
Electric condensers ..	5,57	+ 49
Electric bell apparatus	1,42	+ 8
Electric lighting accessories and fittings, including switches	49,97	— 28
From U.K ..	38,55	+ 10
Meters	67,15	— 40,27
From U.K. ..	38,18	— 21,97
„ *Switzerland*	10,16	— 11
Other electrical instruments	20,80	— 3,04
From U.K. ..	14,84	— 2,97
Electro-medical apparatus	28,72	— 7,57
From U.K. ..	7,55	— 4,87
„ *U.S.A.* ..	9,83	— 1,98
Switchboards other than telegraph or telephone	5,26*	— 5,18
Electrical porcelain ware	4,43	— 1,04
Electrical goods and apparatus not enumerated	2,23,05	+ 22,17
From U.K. ..	1,33,48	+ 23,05
„ *U.S.A.* ..	27,80	— 10,68
„ *Canada* ..	4,48	— 15,67
Control and switchgear	5,48,36	+1,31,05
Generators, alternators and dynamos ..	2,46,30	+ 8,37
Motors	1,22,90	+ 11,16
Transformers	1,44,25	— 30
Turbo-generator sets	1,29,84	— 3,255
Other electrical machinery	5,23,20	— 33,18

* Mainly from United Kingdom.

NEW ELECTRICAL EQUIPMENT

Infra-Red Spectrometer

In recent years infra-red spectrometry has assumed increasing importance as an industrial and scientific tool. The high cost of the equipment currently available, which was developed for research purposes, has, however, tended to limit the most complete use of the technique in industry. There has consequently arisen a demand for a high resolution dispersing instrument covering a specific range of wave-



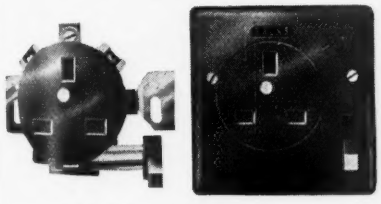
Mervyn-N.P.L. infra-red spectrometer

lengths at a price which would enable it to be used for routine analysis or process control on the widest possible scale.

The availability of the Merton-N.P.L. gratings has enabled this need to be met, and the new Mervyn-N.P.L. spectrometer covering the important 3μ region is the first of a series of such instruments each operating in one specific region of the infra-red spectrum. It can be used as a single beam instrument for identifying particular compounds, incorporating a special new system which enables the instrument to stimulate double beam operation and indicate transmissions directly. The overall stability of the instrument is such that it is eminently suitable for use as a process controller when the grating is locked at one predetermined setting. The instrument is available from MERVYN INSTRUMENTS, LTD., Copse Road, St. John's, Woking, Surrey.

Bracket Fixing Sockets

In the bracket fixing three-pin power sockets introduced by FALK, STADELMANN & CO., LTD., 91, Farringdon Road, London, E.C.1, all cables and



Falk, Stadelmann bracket fixing socket

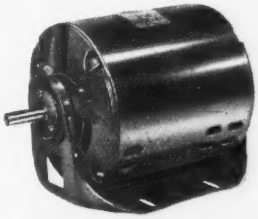
cable terminals are visible whilst the socket is fixed and before the plate is fitted, so eliminating any doubt as to the effectiveness or safety of the connections. Correct fixing is checked, the speed of installation is greatly increased and faults can be ascertained without completely dismantling the socket. The 13 A bracket fixing shuttered socket conforms to the requirements of B.S. 1363 and can be fitted to a standard box of that specification. The 15 A bracket fixing shuttered sockets, either switched or unswitched, also fit the same boxes. All switched patterns are double pole a.c. only. Both brown and white models are available.

Plastic-covered Conduit

A new range of tube, combining the durable qualities of plastic with the rigidity of steel, has been introduced by GEORGE BURN, LTD., Rabone Lane, Smethwick, Birmingham, 40. Marketed under the name of "Burcol," the tubing consists of normal steel tube covered with a skin of p.v.c. material. Six standard sizes are being made varying from $\frac{3}{8}$in to $1\frac{1}{4}$in outside diameter. At present it has been produced in four standard colours, off-white, black, red and apple green.

Motors for Domestic Appliances

The new "A" type f.h.p. motor which has recently been introduced by CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2, has been designed to meet the requirements of the domestic appliance market at home and abroad. Generally, the



Crompton Parkinson "A" type f.h.p. motor

motors will conform to B.S. 170, B.S. 2048, the European C.E.E., Dutch K.E.M.A., Swedish S.E.M.K.O., and the Canadian Standards Association specifications. The motor is built for horizontal, vertical or angle mounting, using a new "Marathon" felt packed unspillable bearing. To allow for the extreme conditions met with in hot countries or situations, a unique frame cooling system has been adopted which keeps the temperature rise to an absolute minimum. For convenience of the user, the "Thermatrip" overload device is available in any one of three possible positions on the endshield. The motor has a high starting and pull-out torque, the latter being most important for power-wringer washing machines. Production has commenced on $\frac{1}{6}$ and $\frac{1}{4}$ h.p. ratings, with the usual resilient or solid base mountings, and also three or four lug endshield fixings where required.

Flameproof Switchgear

A new range of flameproof switchgear has been developed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, which can be used for building two- and three-phase four-wire flameproof medium voltage distribution switch fuse boards which will take currents up to 100 A at 660 V. The individual switch fuse units may also be used alone, if required. There are double-pole and triple-pole (with neutral) switches, fuse

Typical G.E.C. medium voltage flameproof switchboard

chambers and busbar chambers, terminal boxes, conduit adaptors, cable sealing boxes and cable box reverse entry chambers, together with such accessories as support brackets and cover plates for blanking off busbar chambers. Units are completely interchangeable.

The equipment complies fully with B.S. 229 and B.S. 861, and all the units have been tested by the Research Establishment of the Ministry of Fuel and Power at Buxton, and are certified flameproof (FLP) for Groups 1, 2 and 3. The fuse chambers are supplied either with fuseholders for rewirable fuses or with fuseholders for G.E.C. h.r.c. cartridge fuses, the latter being rated in accordance with category 550AC5 of B.S. 88.

Dry Shavers

All "Kub" electric dry shavers made by CHILTON ELECTRIC PRODUCTS, LTD., Hungerford, Berks, are now supplied at no extra cost in an attractive case.

Automatic Control Gear

Expanded Development of Contactor Gear at a Wolverhampton Factory

EXPANSION of production facilities by Contactor Switchgear, Ltd., has proceeded continuously at Blakenhall, Wolverhampton, and the most recent extension, completed about two years ago, very substantially raised production capacity and permitted the provision of a greatly enlarged test department and the setting-up of a case making department. To-day the total factory floor area available amounts to some 44,000 sq ft and further extensions are under consideration.

As is inevitable in the automatic control gear field, a considerable proportion of the company's business is in equipment specially designed and laid out to suit the customer's particular requirements. Nevertheless, on a recent visit a substantial amount of standard control gear of all the usual forms was seen going through the works. Incidentally, a large proportion of the company's components has been approved by the Canadian Standards Association for the building of panels for shipment to Canada.

The flexibility of the designs in general enables the company to deal with a customer's special requirements in the most effective way and this feature is coupled with the use as far as possible of the technique of bulk production of the great variety of sub-assemblies which ordinarily do not have variants and are, therefore, of a highly standardized nature.

The standard range of products comprises units for motors up to approximately 1,000 h.p. both a.c. and d.c.—in the case of the former up to 5,000 V—and a considerable variety of accessories. A noteworthy feature of the general construction adopted throughout is the mounting of the various contactors, relays, etc., on insulated steel bars bolted in turn to steel uprights. Besides giving an assembly of great mechanical strength, this arrangement, coupled with the fact that the gear is air break, provides a very high degree of general accessibility.

The contactors employed are of sturdy and compact construction designed to meet the most severe service conditions. They are fitted with easily renewable butt type contacts, arc shields and, except for the smallest a.c. sizes, magnetic blowouts. Both a.c. and d.c. contactors may be operated by either a.c. or d.c., and all can be either of the electrically held or the latched-in patterns. Auxiliary contacts have clearly received a great deal of attention in order that their performance shall match that of the main contacts.

In the high voltage gear the contactors have long break butt type contacts operating in specially shaped arc shields which in conjunction with magnetic blowouts give exceptionally good arc control. Each contactor is operated by a single magnet, the continuously rated operating coil of which is fed from rectified a.c. normally derived from a small transformer and rectifier mounted within the main enclosure. A feature of the design is a device provided to control the speed of make to eliminate contact bounce on closing, but not interfering with the speed of break.

In general, thermal type overload relays are employed for motor protection, but the magnetic type with oil dashpot time lag is also available when required. The thermal relays are ambient temperature compensated and in the case of the widely used "Chrontactor" overload meter the thermal element of the instrument is fed from special current transformers, the combination enabling close trip settings to be adopted even when starting currents are high and/or starting periods prolonged.

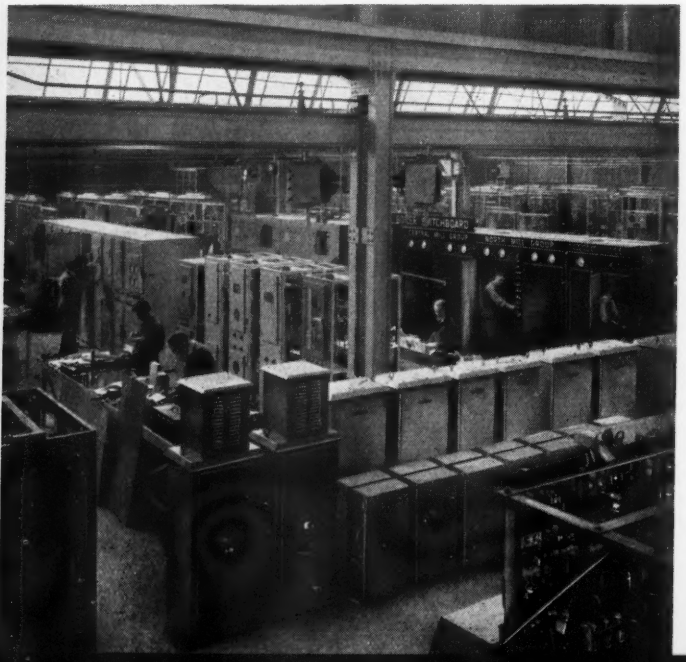
For determining any time interval required between the operation of contactors the "Chrontactor" mechanical timing device is used. This is a simple escapement mechanism which is completely dust-proof, instantaneously resetting and entirely unaffected by variations in ambient temperature.

Attached to the main test department is a special room where components are checked and rechecked on sustained endurance tests to ensure the utmost reliability.

A glance around the works confirmed the versatility and adaptability of the company's gear to a wide variety of industries. Apart from cubicle type boards arranged in from two to five tiers, we also saw units arranged on the above and below busbar principle. Boards and panels for power stations, machine tools, cement works, welding machines, textile drives, furnaces, pumping plant, gas works, tube drawing plant, rolling mills, etc., were among some of the items under construction.

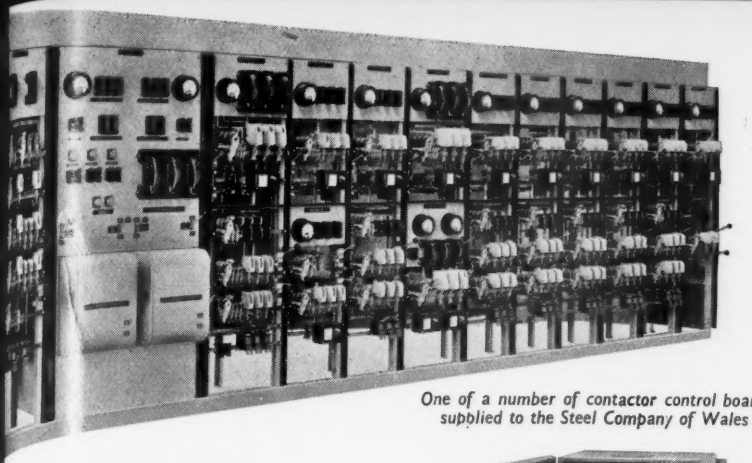
Recent orders include equipment for chemical works, rolling and cement mills, a bloom furnace and cranes; and switchboards for power stations at home and abroad. A considerable amount of work has been done for the Steel Company of Wales, the contracts including open-type switchboards and control desks for the hot and cold finishing departments.

In addition to the large amount of gear which finds its way abroad as indirect exports the company is making continuous efforts in collaboration with its agents overseas to increase further its direct export business.

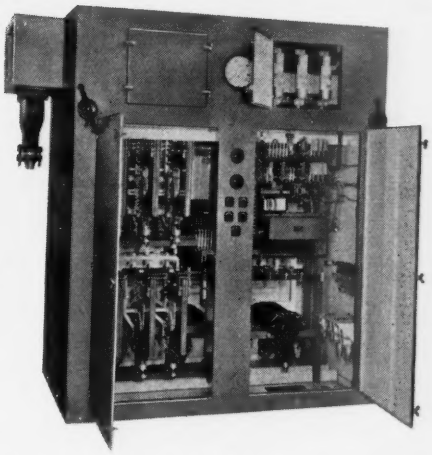


Left: View of part of the main assembly bay at the Contactor Switchgear works at Wolverhampton

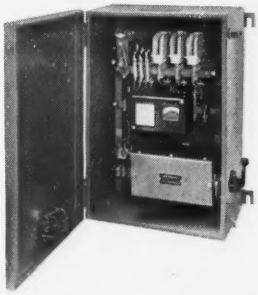
EXAMPLES OF CONTACTOR SWITCHGEAR PRODUCTS



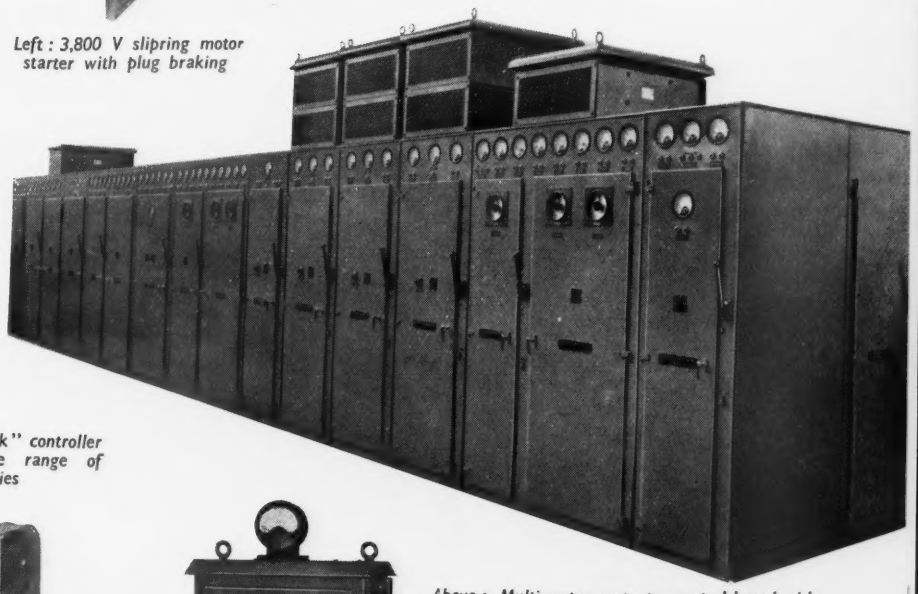
One of a number of contactor control boards supplied to the Steel Company of Wales



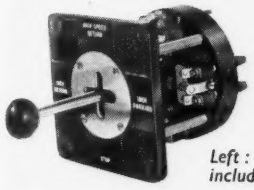
Above : 3,300 V 800 h.p. auto transformer starter with isolator and h.r.c. fuses for each of two incoming supplies. Left : Industrial direct switching a.c. starter



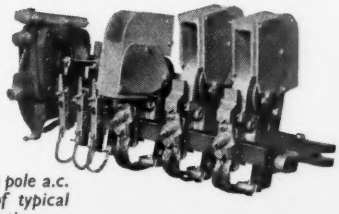
Left : 3,800 V slipring motor starter with plug braking



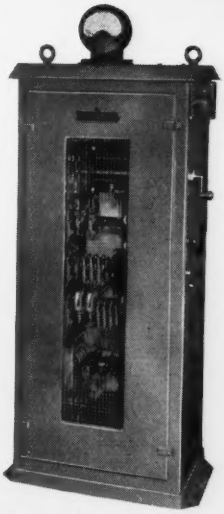
Above : Multi-motor contactor control board with individual isolation and incorporating an extensively interlocked scheme together with 160 kW of heater controls



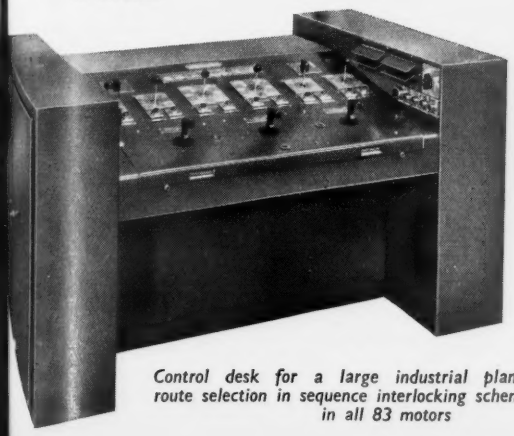
Left : A "joystick" controller included in the range of accessories



150 A triple pole a.c. contactor of typical construction



D.c. contactor starter with shunt field control



Control desk for a large industrial plant embodying route selection in sequence interlocking scheme controlling in all 83 motors

Typical furnace contactor panel with indicating and recording instruments

STOCKS and SHARES

CONTINUANCE of firm conditions in almost all sections of the Stock Exchange is bringing forward an increasing number of new capital issues. In the gilt-edged market, there would be little surprise at news of this sort before long from the British Electricity Authority, which was last in the market in April, 1953, with an issue of £125 million 4¼ per cent stock at 100. The present quotation of 106 for that stock gives the measure of the extent to which interest rates have moved in favour of borrowers during the interval. In the industrial market, the week's company dividend news has been by no means uniformly good, but in spite of a little resultant irregularity the tone remains reasonably confident.

Ward & Goldstone Results

Excellent results announced by Ward & Goldstone, Ltd., covering the year ended last May, induced a rise of 8s 3d in the price of the company's 5s ordinary shares to 63s 3d. They had already risen by about 14s since the beginning of the year. For the fourth year in succession an increased distribution goes to ordinary shareholders, the rate being raised this time from 45 to 50 per cent. From the preliminary profits statement this still appears to involve less than a fifth of the distributable surplus which, at £267,000, shows a further expansion of some 35 per cent, despite a much heavier tax charge. From the very large reserves resulting from a consistently conservative dividend policy, the company has issued three capital bonuses in recent years, and now proposes a further free distribution on a share-for-share basis. A yield on the shares of barely 4 per cent denotes the impressive strength of the position. It is seldom easy to buy them in any large numbers.

Price Changes

Improvements of 1s or more during the past week in English Electrics, G.E.C. and B.I.C.C. exemplified the firm trend among leading industrials. Larger advances, of around half-a-crown, were recorded by Greenwood & Batley, Laurence Scott, British Thermostat, Reyrolle and Southern Areas: the last-named have been notably well supported since the increase in the dividend and publication of the full report. Electrical Components were marked up to 12s, with business recorded up to 12s 6d. Deccas have been changing hands in the neighbourhood of 40s, while E.M.I. and Cossor also advanced. Automatic Telephones were quoted ex the share bonus, and recovered some 1s 6d of the deduction. Oriental Telephones at 81s 3d are 3s 9d up. Stewards & Lloyds' recently re-introduced shares achieved a small premium on the issue price.

Recent Issues

Dealings started in the Anglo-Portuguese Telephone Company's new 6 per

Week's Price Changes

Company or Board	Nom. Value	Middle price 5th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	19[illegible] High-est	19[illegible] Low-est
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	93		3	3	3 4 6	93½	8[illegible]
Brit. Elec. 1974/77	100	92		3	3	3 5 3	92	8[illegible]
Brit. Elec. 1976/79	100	97½		3½	3½	3 11 10	97½	9[illegible]
Brit. Elec. 1974/79	100	106		4¼	4¼	4 0 2	106	[illegible]
Overseas Electric Supply								
Calcutta Elec.	£1	21/6		6†	6†	5 11 7†	21/6	[illegible]
East African Power	£1	20/-		7	7	7 0 0	23/4	[illegible]
Nigerian Elec.	£1	24/6		10	10	8 3 4	25/-	[illegible]
Palestine Elec. "A"	£1	20/6		Nil	Nil	Nil	20/6	[illegible]
Perak Hydro-Elec.	£1	14/-		Nil	6	8 11 6	15/6	[illegible]
Equipment and Manufacturing								
Aberdare Cables	5/-	10/-	−6d	25	12½*	6 5 0	10/6	[illegible]
Aerialite	1/-	11/-		88½	88½	8 0 0	12/3	[illegible]
Allen, W. H.	£1	70/-		15	20	5 14 4	70/-	[illegible]
Aron Elec. Ord.	£1	50/-		20	15	6 0 0	50/-	[illegible]
Assoc. Elec. Ord.	£1	55/-		20	11¼*	4 1 9	55/-	[illegible]
Automatic Tel. & El. ...	£1	68/9xb	+1/6	15	15	—	70/-	[illegible]
Babcock & Wilcox	£1	59/-	−6d	18	12*	4 1 4	59/6	[illegible]
Baldwin, H. J.	2/-	4/3	−3d	20	20	9 8 6	5/6	[illegible]
Bakelite	10/-	26/3		12½	12½	4 15 3	27/6	[illegible]
British Aluminium	£1	37/6		12	10	5 6 8	40/-	[illegible]
B.I. Callender's	£1	44/9	+1/9	10	10	4 9 6	44/9	[illegible]
B.I. Callender's 6% Pref. ...	£1	26/-		6	6	4 12 3	26/-	[illegible]
British Thermostat	5/-	33/9	+2/6	35	27½*	4 1 6	33/9	[illegible]
British Vac. Cleaner	5/-	13/-		25	25	9 12 3	14/6	[illegible]
Brook Motors	10/-	42/6		20	20*	4 14 3	42/6	[illegible]
Brush Ord.	5/-	6/9	+3d	4	6	4 9 0	7/-	[illegible]
Bulgin, A. F.	1/-	3/3		30	30	9 4 6	3/7	[illegible]
Burco	5/-	15/9	+1/3	35	35	5 11 0*	15/9	[illegible]
Chloride El. Storage	£1	63/9	+1/3	20	12½*	3 18 6	63/9	[illegible]
Clarke Chapman	£1	55/6		17½	20	—	57/6	[illegible]
Cole, E. K.	5/-	32/6	−6d	25	27½	4 4 6	33/-	[illegible]
Cossor, A. C.	5/-	8/6	+6d	10	10	5 17 8	8/11	[illegible]
Crabtree	10/-	29/3		17½	17½	5 19 8	29/6	[illegible]
Crompton Parkinson Ord. ...	5/-	18/-	+6d	11¼	20	5 11 0	18/-	[illegible]
De La Rue	5/-	16/3	+3d	Nil	20	6 3 0	16/9	[illegible]
Decca	4/-	38/9	+9d	150	35*	—	38/9	[illegible]
Desoutter	5/-	18/9		18	20	5 6 8	18/9	[illegible]
Dewhurst	2/-	6/-		19	19	6 6 9	6/3	[illegible]
Dictograph Tel.	2/-	6/-		20	20*	6 13 4	6/3	[illegible]
Dubilier Condenser	1/-	5/6		28	25*	4 11 0	6/-	[illegible]
E.M.I.	10/-	16/6	+9d	12	8	4 17 0	16/6	[illegible]
Electrical Components	5/-	12/-	+9d	20	20	8 6 8	12/-	[illegible]
Elec. Construction	£1	61/3		15	15	4 18 0	61/3	[illegible]
Enfield Cable Ord.	£1	21/3	+1/3	5	Nil	Nil	22/3	[illegible]
English Electric	£1	46/3	+1/3	15	10*	4 6 6	46/3	[illegible]
English Electric 3¾% Pref. ...	£1	16/6		3¾	3¾	4 11 0	16/6	[illegible]
Ericsson Tel.	5/-	25/9		22†	25†	2 8 6†*	26/3	[illegible]
Ever Ready	5/-	23/6		35	40	—	25/-	[illegible]
Falk Stadelmann	£1	38/-	+6d	15	15	7 18 0	41/-	[illegible]
G.E.C. Ord.	£1	43/9	+1/3	22½	11¼*	5 2 9	44/6	[illegible]
G.E.C. 6¼% Pref.	£1	27/-		6¼	6¼	4 16 3	27/3	[illegible]
General Cables	5/-	16/3		30	30	9 4 8	16/10	[illegible]
Greenwood & Batley	£1	48/9	+2/6	17½	17½	7 3 6	48/9	[illegible]
Hackbridge Cable	5/-	14/6	+6d	20	20	6 18 0	15/3	[illegible]
Hackbridge & Hewittic	5/-	22/6		20	25	5 11 0	22/6	[illegible]
Hall Tel. Acc.	10/-	11/-	+6d	10	10	9 1 9	11/11	[illegible]
Heatrae	2/-	4/9		12½	12½	5 5 3	4/9	[illegible]
Henley's	10/-	19/3	−3d	10½	10½	5 9 1	19/6	[illegible]
Holophane	5/-	15/3		20	20	6 11 2	15/3	[illegible]

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

cent preference shares at a premium of 6d. The public offer of a million of the shares at par was well oversubscribed. The premium on the same company's new £1 ordinary shares, offered to existing shareholders by way of "rights" at a price of 20s, increased to 3s 6d. Telegraph Construction & Maintenance new 5 per cent preference shares are now fully paid and quoted at 7½d premium. Among "rights" issues, Plessey new 10s shares, offered at 30s, have been dealt in at around 50s 3d. News is awaited of issues by the Pye and Ekco companies. Letters in connection with the Broadcast Relay Services issue of shares at 32s 6d are expected to be in shareholders' hands about 13th July.

in Electrical Investments

Company or Board	Nom. Value	Middle price 5th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1954 Highest	1954 Lowest
Equipment and Manufacturing—continued.						£ s d		
Hoover	5/-	37/3		25	45	6 0 9	37/3	26/3
I.C	£1	71/9	+1/9	13	15	4 1 1	72/-	52/9
Int. Combustion	5/-	24/-	+1/-	15	20	4 3 4	24/-	14/6
Johnson & Phillips	£1	48/-		15	15	6 5 0	52/3	47/6
Lancashire Dynamo	£1	56/9		12½	14	4 18 9	56/9	43/-
Laurence, Scott	5/-	23/9	+2/-	15	20	4 4 3	23/9	14/-
Lissen, R. A.	£1	43/6	+6d	9	12	5 10 4	43/6	31/9
London Elec. Wire	£1	45/-		15	10*	4 9 0	46/3	38/-
Lucas, J.	£1	67/6	+1/3	9½	10½	3 4 3	67/6	50/3
Mavat & Scott	2/-	7/-		22½	25	7 2 9	7/-	5/11
Mather & Platt	£1	73/6	+1/-	12½	15	4 1 6	73/6	53/1
Metal Industries	£1	30/9	−1/6	12	9	5 17 0	42/3	29/6
Midland Elec. Mfg.	£1	67/6		15	15	4 9 0	67/6	63/-
Murphy-Richards	4/-	18/9		40	40	—	18/9	11/4
Murex	£1	56/3	+6d	15	15	5 6 9	56/3	50/-
Newman Ind.	2/-	2/3		10	10	8 17 9	2/6	2/-
Oldham & Son	1/-	3/-		35	17½*	5 16 8	3/4	2/5
Parnall (Yate)	5/-	6/3	−6d	6	8	6 8 0	6/9	4/3
Parsons, C. A.	£1	55/-	−1/3	12½	7½*	2 14 6	56/3	38/1
Plessey	10/-	51/-	+2/3	25	30	—	54/-	37/10
Pye Deferred	5/-	27/-	+9d	20	20*	3 14 0	27/-	15/7
Revo	10/-	18/3	−2/-	27½	9*	4 18 9	20/3	16/7
Reyrolle	£1	88/9	+2/6	12½	13½	3 2 0	88/9	66/-
Rheostatic	4/-	12/6		19	20	6 8 0	12/9	11/-
Richardsons Westgarth	5/-	11/9		12	15	—	11/9	6/6
Scottish Cables	4/-	17/-		20	27½	6 9 6	17/3	12/11
Siemens Ord.	£1	37/-	+6d	10	10	5 8 0	43/9	33/9
Smith (England), S.	4/-	10/6	−3d	12½	15	—	11/3	7/8
Southern Areas	£1	21/3	+2/9	6	7½	7 1 3	21/3	17/6
Strand Elec.	5/-	8/9		17½	17½	10 0 0	9/3	8/3
Sturtevant	5/-	38/6		18·1†	18·9*†	2 9 0†	38/9	29/-
Sun Elec.	£1	32/6		15	15	9 4 8	32/6	27/6
Switchgear & Cowans	5/-	12/9		22½	10	3 18 6	13/7	9/9
Taylor Tunnicliff	5/-	11/-		25	12½*	5 13 9	12/4	10/7
T.C.C.	10/-	32/6		20	30*	—	32/6	21/3
T.C. & M.	£1	30/9	+6d	10	8½*	5 10 7	34/6	30/3
Telephone Mfg.	5/-	8/6		10	10	5 17 9	8/6	7/6
Thorn Elec.	5/-	19/9	+3d	12½	12½	3 3 3	19/9	13/3
Thornycroft	£1	42/6		15	15	7 1 3	42/6	33/4
Tube Investments...	£1	67/6	+1/3	15*	15	4 9 0	68/9	60/3
Vactric	5/-	14/6		Nil	10	3 9 0	17/6	7/6
Veritys	5/-	6/9		10	12½	9 5 3	8/3	5/-
Walsall Conduits	4/-	52/6		70	70	5 6 8	52/6	44/-
Ward & Goldstone	5/-	63/3	+8/3	45	50	3 19 0	63/3	41/3
Watford	2/-	6/-		25	22½*	—	6/3	4/7
Westinghouse Brake	£1	68/9	+1/3	14	15	4 7 3	68/10	60/9
West, Allen	5/-	15/-	+3d	15	17½	5 16 9	15/3	12/7
Wolf Electric	5/-	13/9		15	17½	6 7 3	13/10	11/-
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A Ord.	100	82½		—	6	7 5 6	89½	80
Ord.	100	52½		—	3¾	7 2 10	55½	52
Anglo-Portuguese	£1	23/6	+1/9	8	8	6 16 3	24/-	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	57/-	+2/-	35	50	4 7 9	57/-	39/1
Cable & Wireless:								
Ord.	£1	38/-		8	9	4 14 9	40/6	26/2
4% Loan	100	98½		4	4½	4 1 3	98½	95½
Calcutta Trams	£1	19/-		6†	2½†	—	19/3	17/1
Cape Elec. Trams	£1	15/-		5½	5½	7 6 8	15/3	12/4
Marconi Marine	£1	33/9		10	10	5 18 6	33/9	27/6
Oriental Tel. Ord.	£1	81/3	+3/9	16	16	—	81/6	73/9
Telephone Props.	£1	4¾		8	8	—	5 1/16	4¼
Telephone Rentals	5/-	9/6	+6d	10	10*	—	10/3	9/-

Pye Dividend

The strength of Pye 5s deferred shares in advance of the annual dividend and results proved to be well justified in the event. At 27s the price improved further, after the announcements, upon the 10s rise which has taken place during the earlier course of this year. (The "A" deferred shares, which carry no voting rights, are quoted 3d lower). The 20 per cent dividend is at the same rate as last year's, but goes to capital increased since then by the 50 per cent share bonus, so that this time shareholders receive in effect half as much again. Trading profits of the group are shown to have expanded, in very similar proportion, to the record total of £1·1 million. Most of the increase is drained off by a £360,000 rise in the tax provision, at £868,000; even so, the deferred dividend distribution is covered comfortably twice over by the net surplus.

Dividends Declared

Oldham & Son report a moderate improvement in profits for the year ended in May, and the maintenance of the dividend at a total of 17½ per cent. The price of the 1s shares is unaltered at 3s. Metal Industries £1 shares, now 30s 9d, were affected by the reduction in the dividend for the latest year to 9 per cent. Revo Electric's final dividend makes a total of 9 per cent on capital trebled since last year by the two-for-one bonus; the total is thus nearly equivalent to the 27½ per cent paid last time. Profits during the period were reduced by the extra costs arising from a works reorganization and by other factors. The 10s shares were subsequently quoted at 18s 3d. Associated Insulation Products are also repeating last year's rate of dividend, at 20 per cent, from lower profits. The 5s shares were quoted at 16s.

Walsall Conduits

Final distributions declared by Walsall Conduits bring the total for 1953 to 70 per cent. This is the same as was paid last year, when the rate was maintained on capital increased by a one-for-three share bonus. Of the distribution, 15 per cent is declared as bonus. An advance of £45,000 in the group trading profit for the year is shown, in the preliminary statement, to have been more than offset by larger tax provisions, with the result that the net surplus comes out rather below the previous figure at £146,000. This provides roughly two-fold cover for the ordinary distribution, on the basis of which the shares at 52s 6d pay £5 6s 8d per cent on the money.

REPORTS and DIVIDENDS

Walsall Conduits, Ltd., reports a trading balance for 1953 of £444,938, as compared with £399,327 for 1952, to which is added interest on investments of £5,097. After meeting all charges, including £253,562 for taxation, there is a net profit of £153,010 (against £174,211). General reserve receives £20,000 and it is proposed to pay a final ordinary dividend of 35 per cent, and a bonus of 15 per cent, making 70 per cent for the year (unchanged). The balance carried forward is £706,868 (against £656,295 brought in).

In his circulated statement, Mr. A. E. Read (chairman) says that the decline in demand which occurred in 1952 continued until September, 1953, when an abrupt change took place; demand suddenly increased and they were again in full production. During the year competition was keen whilst costs continued to rise, but reorganization in methods of production enabled them to absorb all additional costs and even to reduce many selling prices. They have continued to extend their range of products, and also the area of sales. Exports for the year reached record figures. Sales for the first five months of the current year exceed those of the same period last year, and at the present time they have a full order book.

Permali, Ltd.—A group trading profit of £72,434 is shown in the report and accounts for the year ended 3rd April last, as compared with £83,042 for 1952–53. Taxation requires £43,696, less £5,000 over-reserved. It is proposed to pay a final dividend of 7 per cent, making 11 per cent on the increased and reconstructed capital of £225,000. Last year 12 per cent was paid on £100,000 and 0·7d per 2s 6d share on £25,000. The balance carried forward is £30,887 (against £18,644 brought in).

Mr. C. F. Hitchins (chairman) in his circulated statement says that the company has further consolidated its position as suppliers to the heavy electrical industry, the British Electricity Authority, and to the Railway Executive. In the latter field Permali insulated rail joints for track circuit signalling are now installed in the Scandinavian countries, as well as in Africa, India and some of the South American Republics. The demand for bakelized paper bushings, as used in the electrical industry, has expanded considerably.

The Hackbridge & Hewittic Electric Co., Ltd.—The report and accounts now published confirm the preliminary figures given in our issue of 2nd July.

In his circulated statement Mr. T. F. Lister (chairman) says that in order to meet the demands for higher voltage transformers and to facilitate and improve the methods and conditions of manufacture, it was decided to extend the main transformer assembly bays and test equipment. It is hoped to have this extension available for use within a few months thereby putting the company in a position to quote much earlier delivery dates for transformers of the largest capacity and highest operating voltages. This tendency towards larger units applied to the rectifier division also and during the past year the two largest rectifier installations made by the company were commissioned in the United States. These are the largest glass bulb unit installations in the world. Other large rectifier installations put into service during the year were eight substations for the British Railways Southern Region (out of a total of 28 on order) and a change-over scheme at Bond Street for London Transport which is to be followed by a similar but larger installation at Charing Cross.

The order book is satisfactory and ensures full output in all divisions during the coming year. Incoming orders, however, show a decline over previous years which may affect output during the following year unless there is a change for the better in the near future. In the export market, sales have become particularly difficult, owing to import and financial restrictions. Where markets are still open and available for their products they are faced with increasing and keen competition, particularly from Continental manufacturers.

The Revo Electric Co., Ltd., recommends a final dividend of 5½ per cent actual, less tax, on the ordinary shares, making 9 per cent actual for the year to 31st March last. The consolidated profit for the year after all charges, including taxation, is £48,904, which compares with £171,590 for the previous year. United Kingdom taxation was £90,031. The directors state that the decrease in profit for the year is due to a number of adverse factors, the most important of which are the extra costs arising from reorganization of the works and coinciding with this a general recession in trade in the first part of the year, together with increased costs in all directions throughout the year without it being possible to make corresponding adjustments in selling prices.

The Oriental Telephone & Electric Co., Ltd.—The group net profit for 1953 (subject to final audit), after deducting £51,415 for taxation, is £211,549, as compared with £113,610 for the previous year. It is proposed to pay a final dividend of 12 per cent., maintaining the distribution for the year at 16 per cent. The directors state that consequent to the acquisition of the company's telephone business on 31st December next, the basis of assessment to income tax and of the charge in the profit and loss account in respect thereof is changed. As a result £66,055 previously set aside and now rendered surplus has been credited in the profit and loss appropriation account. The profits of the group have been increased as a consequence of an increase in the results of branch trading of £68,247 and a reduction in the taxation charge of £26,821.

Ward & Goldstone, Ltd., report a consolidated net profit for the year to 31st March last of £266,616, after deducting taxation of £411,674. This compares with a net profit of £197,536 for the previous year. It is proposed to pay a final dividend of 35 per cent (against 30 per cent), making 50 per cent for the year (45 per cent). The balance carried forward is £345,163 (against £129,194 brought in). Treasury consent has been obtained to a one-for-one scrip issue to ordinary shareholders.

Johnson, Matthey & Co., Ltd., report a group net profit for the year to 31st March last of £556,011, as compared with £638,825 for the previous year. Taxation charged was £551,125. It is proposed to pay a final ordinary dividend of 18 per cent, making 21 per cent for the year (against 15 per cent). The consent of the Capital Issues Committee has been obtained to a 200 per cent scrip issue.

Pye, Ltd.—The group profit for the year to 31st March last is £1,127,886, as compared with £743,973 for 1952–53, and after providing £868,196 for taxation, the net balance is £23,973 higher at £259,690. The deferred ordinary dividend is unchanged at 20 per cent, but is paid on capital enlarged by a 50 per cent scrip issue. The 2 per cent participation for the 8 per cent preferred ordinary again makes 10 per cent for the year.

Hick, Hargreaves & Co., Ltd.—After providing £245,633 for taxation, the net profit for the year to 31st March last is £208,107, as compared with £168,065 for the previous year. It is proposed to pay a final dividend of 15 per cent, making 20 per cent for the year. This is at the same rate as for the previous year, but the final dividend is paid on capital increased in January last by a 50 per cent free scrip issue.

Lightfoot Refrigeration, Ltd.—The consolidated trading profit for 1953 is £56,785, as compared with £65,881 for 1952, and after deducting taxation of £22,837, and depreciation of £18,676, the balance available to the parent company is £16,624 (against £16,348). General reserve receives £10,516 and it is proposed to pay a final ordinary dividend of 3 per cent, again making 6 per cent for the year. The balance carried forward is £40,800 (against £45,244 brought in).

The Rothermel Corporation, Ltd.—A group trading profit of £156,248 is shown in the report and accounts for 1953, as compared with £143,171 for 1952, and after meeting all charges, including £54,125 for taxation, the net balance is £56,292 (against £32,627), of which £35,216 is retained in the subsidiary companies and £21,076 is dealt with in the accounts of the parent company. The dividend on the ordinary stock for the year is maintained at 20 per cent with a final payment of 10 per cent, and in addition a bonus of 2½ per cent is paid. The balance carried forward is £155,685 (against £111,238 brought in).

In his circulated statement Sir Reginald Whitty (chairman) says that the turnover to date during the current year is approximately 10 per cent up on last year's figures. A special meeting is to be held following the annual meeting on 23rd July at which a resolution will be submitted changing the name of the company to Motor & Electronics Corporation, Ltd.

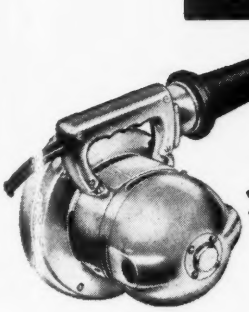
The Telegraph Construction & Maintenance Co., Ltd., announces that, in response to its offer to shareholders of 500,000 5 per cent cumulative redeemable preference shares, 90 per cent of the rights were taken up. The balance of the shares was subscribed for over ten times. Allotments against applications for additional shares will therefore have to be drastically curtailed.

New Companies

Solartron Electronic Group, Ltd.—Registered 23rd June. Capital £150,000. To acquire not less than 90 per cent of the shares in Solartron Laboratory Instruments, Ltd., and Solartron Engineering, Ltd., and of a company about to be formed to be known as Solartron Research and Development, Ltd., and to carry on the business of electronic, electrical, tele-

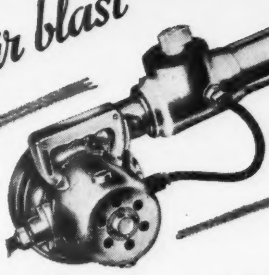
(Continued overleaf)

MARTINDALE



A portable air blast

or



hot air on tap

The long thin insulated nozzle makes it possible to blow out dust from the most awkward corners of electric switchgear, motors electronic equipment and other plant, even when "alive." A selection of five machines of various sizes is available to cover all kinds of work where either a blower or a portable vacuum cleaner is required.

Martindale Hot Air Blowers, in powers from 500 — 3,000 watts, are ideal for the quick drying of windings of all kinds before and after varnishing, and for many other purposes connected with the electrical industry. Can be used with the heat off as blowers for dust removal and vacuum cleaning.

Martindale Portable Blowers are of first-class construction and guaranteed for a year against faulty workmanship. Supplies from stock.

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Legg Industries Limited design and manufacture Charging Equipment for Electric Vehicles and Trucks of all types and the majority of leading manufacturers specify LEGG CHARGERS for use with their equipment—both at Home and Abroad.

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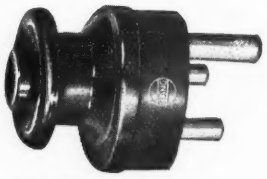

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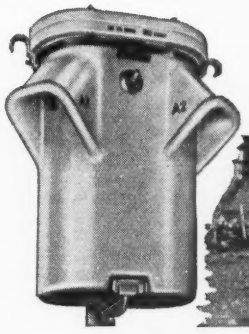
British Power Transformers

for rural distribution

in hermetically-sealed stoneware containers



Photograph by courtesy of British Insulated Callender's Construction Co. Ltd. and the North of Scotland Hydro-Electric Board.

- No maintenance costs. Containers are salt and acid proof. Supporting steel work is heavily galvanised. Hermetically sealed container protects oil from acidity.
- Increased efficiency and reduced operating costs due to low losses.
- High Overload Capacity.
- Simple installation—only one or two bolts required. Other types of distribution transformers, including units to the Draft National Standard Specification T.1. in steel tanks, can also be supplied.

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Telephone: HOWard 1492 QUEENSWAY, PONDERS END, MIDDLESEX *Telegrams: Vitrohm Enfield*

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graphic, telephonic, radio, television and general engineers, etc. First directors: J. E. Bolton, L. B. Copestick, E. R. T. Ponsford and J. E. Crosse (all directors of Solartron Engineering, Ltd.), and W. A. Croft and E. E. Jones (director Uniscam Products, Ltd.). Secretary: I. E. Belchambers. Regd. office: Queens Road, Thames Ditton, Surrey.

Cossor Service, Ltd.—Registered 21st June. Capital £100. To render services to owners, dealers, manufacturers, users or others in connection with the installation, repair and maintenance of electrical and electronic devices and apparatus, etc. Directors: H. Chisholme and J. S. Clark (directors of Sterling Cable Co., Ltd., etc.) and H. T. Shepherd. Secretary: N. Stiller. Regd. office: Cossor House, Highbury Grove, N.5.

Wonder Washing Machine Co., Ltd.—Registered 13th May. Capital £1,000. Manufacturers of and dealers in washing machines of all kinds, etc. Directors: P. B. Courtney and V. H. D. Hennell. Regd. office: 228, Harrow Road, W.2.

Plumstead Electrical Co., Ltd.—Registered 16th June. Capital £100. Directors: J. A. Proctor, Gertrude M. Proctor, P. W. Tricker, D. Perfect and F. J. Pye. Regd. office: 163 Burrage Road, Woolwich, S.E.18.

Harrison & Makin, Ltd.—Registered 20th May. Capital £25,000. Electrical engineers, etc. Permanent directors: H. M. Harrison, J. Makin and W. H. Harrison. Secretary: J. Harwood. Regd. office: 18–20, Market Street, Bolton.

Liquidations

Micox Electrical Equipment, Ltd.—Winding up voluntarily. Liquidator, Mr. D. A. Lumley, 2, Burwood Road, Hersham, Surrey, appointed 15th June.

Peco (Electrical Contractors), Ltd.—Meetings 13th August at the offices of Poppleton & Appleby, 31, Lloyd Street, Manchester, 2, to receive an account of the winding-up by the liquidator, Mr. R. F. Bendall.

F. W. Shearman, Ltd., electrical retailers.—Winding up voluntarily. Liquidator, Mr. M. Collier, 199, Piccadilly, London, W.1, appointed 22nd June.

Bankruptcies

H. Bullock, trading as H. Bullock & Sons, 17, High Street, Bromyard, Herefordshire, electrical engineer.—First and final dividend of 2s 11d in the £, payable on and after 17th July at the Trustee's office, Colmore House, 21, Waterloo Street, Birmingham, 2.

E. T. M. Marshall, residing at 59, Denham Road, Burgess Hill, Sussex, radio engineer, and formerly carrying on business at High Street, Hurstpierpoint, under the style of G.E.M. Radio Electric, as a radio and electrical dealer.—Receiving order made 22nd June on debtor's own petition.

H. Schofield, 97, Deardengate, Haslingden, Lancs., trading as the Greenfield Electric Co., electrical and radio engineer.—Trustee, Mr. F. C. Ormrod, 20, Byrom Street, Manchester, 3, Official Receiver, released 22nd June.

J. Barnett and **M. Barnett,** trading as Barnett Supplies Co., at 102 and 104c, Cranbrook Road, Ilford, Essex, radio, electrical and television dealers and contractors.—Trustee, Mr. N. W. Osborne, 11–12, Finsbury Square, London, E.C.2, released 17th May.

B.E.A. Contracts

CONTRACTS placed by the British Electricity Authority during the past month for power stations, transforming stations, and transmission lines amount to £26,735,766. The principal items include the following:—

Acton Lane "B" power station, Willesden: Two 30,000 kW turbo-generators, condensing and feed heating plant.—Richardsons, Westgarth (Liverpool).

Belvedere, Kent: Two 60,000 kW turbo-generators.—English Electric Co. Three 550,000 lb/hr boilers.—John Brown & Co. (Clydebank). Condensing and feed heating plants for two 60,000 kW turbo-generators.—Mirrlees Watson Co.

Hackney: One 30,000 kW turbo-generator and feed heating plant.—C. A. Parsons & Co. Condensing plant for one 30,000 kW turbo-generator.—Worthington-Simpson.

Barking, London: One 550,000 lb/hr boiler.—Babcock & Wilcox.

Brighton "B": Superstructure work.—John Morgan (London). One 60,000 kW turbo-generator, condensing and feed heating plant.—Richardsons, Westgarth (Liverpool).

East Yelland, near Barnstaple: One 30,000 kW turbo-generator and feed heating plant.—C. A. Parsons & Co. Condensing plant for one 30,000 kW turbo-generator.—G. & J. Weir. One 180,000 lb/hr boiler.—John Thompson Water Tube Boilers.

Goldington, Bedford: One 30,000 kW turbo-generator.—British Thomson-Houston Co. Condensing and feed heating plant for one 30,000 kW turbo-generator.—G. & J. Weir.

South Denes, Yarmouth: Ash and dust handling plant.—B.V.C. Industrial Constructions.

Tilbury: One 540,000 lb/hr boiler.—John Thompson Water Tube Boilers.

Castle Donington, near Derby: Two 100,000 kW turbo-generators, condensing and feed heating plants.—Metropolitan-Vickers Electrical Co. Three cooling towers.—Mitchell Construction Co.

Willington, near Derby: One 100,000 kW turbo-generator, condensing and feed heating plant.—English Electric Co. Ash and dust handling plant.—Babcock & Wilcox.

Hams Hall "C," near Birmingham: Three 550,000 lb/hr boilers.—Simon-Carves. Coal handling plant.—Mitchell Engineering.

Ocker Hill, Tipton, Staffs.: Two 30,000 kW turbo-generators with feed water heating, condensing plant and auxiliary apparatus.—Richardsons, Westgarth & Co.

Uskmouth "B," Newport: One 60,000 kW turbo-generator.—English Electric Co. Condensing and feed heating plant for one 60,000 kW turbo-generator.—Vickers-Armstrongs.

Dolgarrog, Caernarvonshire: One 10,000 kW hydro-turbo-generator.—Boving & Co.

Ferrybridge "B," Yorks: One 100,000 kW turbo-generator, condensing and feed heating plant.—C. A. Parsons & Co.

Wakefield, Yorks: One 60,000 kW turbo-generator and feed heating plant.—English Electric Co.

Skelton Grange, Leeds: Three 550,000 lb/hr boilers.—International Combustion.

Thornhill, near Dewsbury: 33 kV main switchgear.—A. Reyrolle & Co., Ltd.

Elland, Yorks: One 60,000 kW turbo-generator. — Metropolitan-Vickers Electrical Co. Condensing and feed heating plant for one 60,000 kW turbo-generator.—Vickers-Armstrongs. One 550,000 lb/hr boiler and ancillary equipment.—Yarrow & Co.

Mexborough, Yorks: Two 30,000 kW turbo-generators.—English Electric Co.

Stella North, near Newcastle-upon-Tyne: 550,000 lb/hr boiler.—Clarke, Chapman & Co.

Stella South: One 550,000 lb/hr boiler.—Clarke, Chapman & Co.

Barony, Ayr: Ash and dust handling plant.—Babcock & Wilcox.

Dalmarnock, Glasgow: One 60,000 kW turbo-generator, condensing and feed heating plant.—C. A. Parsons & Co. Coal handling plant.—W. J. Jenkins & Co.

Pyle 132 kV substation, Glam.: Site and foundation works.—Holland & Hannen & Cubitts.

Barton substation, Staffs: Uprating of 132 kV 2,500 MVA switchgear.—Metropolitan-Vickers.

Stafford substation: Two 30 MVA 132/11 kV transformers.—English Electric Co.

Churchill-Melksham, Wilts: 132 kV line.—W. T. Henley's Telegraph Works Co.

Street Lighting Notes

FOR dealing with the complex problem of efficient lighting in the CITY OF LONDON, a special vertical, wall mounted, fluorescent lantern was devised by Siemens Electric Lamps and Supplies, Ltd., in conjunction with the city engineer (Mr. F. J. Forty). First installed in King Street near Guildhall in May, 1953, these "City of London" lanterns house three 5ft 80 W Siemens fluorescent tubes, and in most instances were mounted direct on to the faces of buildings fronting King Street. A further installation is now to be made on the route from Holborn Circus to Cornhill. Some 83 "City" lanterns are to be used; 59 will be vertically mounted on building faces and approximately 12 pairs will be erected back to back on existing columns.

The Ministry of Housing and Local Government has approved the YORK city engineer's estimate for the installation of street lighting on the Chapel Fields estate at a total cost of £5,984.

NEWBROUGH (Northumberland) Parish Council has approved an electric street lighting scheme costing £457.

For improving the lighting of a number of streets IPSWICH Paving and Lighting Committee has recommended the acceptance of the tender of the General Electric Co., Ltd., for the provision of columns, lamps, etc., at a total cost of over £6,000, and the quotation of the Eastern Electricity Board for the installation of cables.

BURTON-ON-TRENT Public Works Committee is to invite tenders for the installation of fluorescent lighting in Horninglow Road, Tutbury Road and Derby Street.

Cost of Atomic Power

Addressing the Scientific Committee of the French Chamber of Deputies last week, Sir John Cockcroft, director of the Atomic Energy Research Establishment, said that some electricity from atomic power would be available in England at a penny a unit. Even the most pessimistic estimate put the cost at no higher than 30 per cent above the cost of coal-produced electricity. Sir John said that his department was engaged in methods of producing "heavy water" at a cheaper rate.

Much was expected of the fast fission breeder reactor. He considered that nuclear power stations to develop 5,000 MW could be constructed in three years, but first he envisaged an eight-year period for the building and operation of the first two stations. The provision of 5,000 MW could thus be achieved between 1965 and 1970.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 18th August from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

1219. McMichael Radio, Ltd., and Buckmaster, H. F.—Cathode-ray tube systems. 17th January, 1951. (713732.)

1987. General Electric Co., Ltd.—Communication apparatus. 16th January, 1951. (713631.)

10136. Johnson, Matthey & Co., Ltd.—Grid wires for electron-discharge devices. 8th March, 1951. (713942.)

13400. Macfarlane Engineering Co., Ltd., Macfarlane, J. C., and Macfarlane, W. I.—Electric generators. 29th November, 1951. (713633.)

17611. Thorn Electrical Industries, Ltd.—Supply circuits for electric-discharge tubes. 8th May, 1951. (713734.)

21327. Henley's Telegraph Works Co., Ltd., W. T., and Davis, W. C.—Electric fuse carriers. 29th August, 1951. (713636.)

21861. Elton, E. G.—Illumination devices. 5th December, 1951. (713737.)

30772. Huwyler, A.—Speed governor for electric motors. 18th December, 1950. (713944.)

31334. Tweedales & Smalley (1920), Ltd.—Controlling of electric motors of the induction type. 24th March, 1952. (713945.)

1951

4646. Standard Telephones & Cables, Ltd.—Detection of movement by radioactive materials. 22nd February, 1952. (713840.)

5149. Marconi's Wireless Telegraph Co., Ltd.—Cathode-ray display tube apparatus. 23rd January, 1952. (713641.)

7714. Metropolitan-Vickers Electrical Co., Ltd.—Apparatus for examining waveforms. 3rd April, 1952. (713842.)

7719. Compagnie Générale d'Eléctro Céramique.—Electrically conducting porous materials. 3rd April, 1951. (713645.)

8045. General Electric Co., Ltd., and Tombs, N. C.—Electromechanical devices comprising dielectric operating elements. 28th March, 1952. (713752.)

8988. General Electric Co., Ltd., and Gallizia, E.—Vapour electric arc convertors. 19th June, 1952. (713754.)

10171. Standard Telephones & Cables, Ltd.—Electrical measuring instruments. 30th April, 1952. (713649.)

13282. Heron, A. G.—Electrically heated muffler for containers. 23rd June, 1952. (713653.)

14655. Metropolitan - Vickers Electrical Co., Ltd.—Short-path fractionating stills. 5th June, 1952. (713759.)

15792. General Electric Co., Ltd.—Instruments for performing calculations. 3rd July, 1952. (713655.)

16119. Larkby & Scott, Ltd.—Apparatus for recording electric variations. 24th June, 1952. (Cognate application 22353, 24th September, 1951.) (713762.)

17573. Electric & Musical Industries, Ltd.—Cathode-ray tube circuits. 2nd July, 1952. (713764.)

18433. E.M.P. Electric, Ltd.—High voltage electric current limiting fuses. 1st August, 1952. (713663.)

21088. Isopad, Ltd., and Reik, H.—Electric heating mantles. 5th September, 1952. (713768.)

21570. British Telecommunications Research, Ltd.—Frequency dividing regenerative modulators. 4th September, 1952. (713667.)

22137. Forges et Ateliers de Constructions Electriques de Jeumont. Electric circuit interrupting fuses. 21st September, 1951. (713960.)

23767. Electric & Musical Industries, Ltd.—Thermally actuated electric cut-outs. 2nd October, 1952. (713773.)

24120. Metropolitan - Vickers Electrical Co., Ltd.—Electric circuit arrangements for controlling sweep voltages. 12th August, 1952. (713962.)

24122. Metropolitan - Vickers Electrical Co., Ltd.—Turbines. 13th October, 1952. (713671.)

24992. Radio Corporation of America.—Frequency convertors. 25th October, 1951. (713674.)

25090. Cathodeon, Ltd.—Television pick-up tubes. 26th January, 1953. (713858.)

26438. British Thomson-Houston Co., Ltd.—Electric current convertors. 15th August, 1952. (713968.)

26916. Lambert, W. R.—Combined electric plug and switch. 17th November, 1952. (713676.)

26994. British Insulated Callender's Cables, Ltd.—Compression type electric cable glands. 14th November, 1952. (713864.)

27618. Electrical Instrument Co. (Hillington), Ltd., Neumann, F., and Parton, J. E.—Pointer type electrical indicating instruments. 11th June, 1952. (713680.)

27853. Electric & Musical Industries, Ltd.—Generation of television signals by scanning kinematograph film. 28th November, 1952. Addition to 650,879. (713970.)

28125. Westinghouse Brake & Signal Co., Ltd., and King, K. G.—Magnetic amplifier control apparatus. 25th September, 1952. (713866.)

30205. East Midlands Electricity Board, and Carter, F. T.—Electric cookers. 22nd December, 1952. (713869.)

1952

170. General Electric Co., Ltd., and Williams, C. E.—Circuit arrangements for operating low-pressure electric discharge lamps. 2nd January, 1953. (713784.)

1319. Ceskoslovenske Zavody Tezkeho Strojirenstvi, Narodni Podnik, and Houst, F.—Electric circuit breakers having arc-quenching means. 16th January, 1952. Addition to 703,101. (713789.)

1653. British Thomson-Houston Co., Ltd.—Electrically heated panels. 21st January, 1952. (713684.)

2662. Hanovia Chemical & Manufacturing Co.—Automatic wattage regulators for electrical devices. 31st January, 1952. (713796.)

2784. Edison Swan Electric Co., Ltd.—Cathode-ray tubes and display systems including cathode-ray tubes. 1st February, 1952. (713875.)

3152. Birch, H. A.—Variable electrical resistances. 26th January, 1953. (713,687.)

3153. Electrical resistances. 26th January, 1953. (713688.)

3347. Allmanna Svenska Elektriska Aktiebolaget. — Air-blast electric breaker. 8th February, 1952. (713798.)

3915. Wigeland, A. R.—Cable connectors for electric storage battery terminals. 14th February, 1952. (713800.)

4758. Charlotte, H. F.—Electron-discharge devices. 22nd February, 1952. (713879.)

5440. Cole, Ltd., E. K., and Burnard, C. L.—Audio frequency amplifiers. 2nd March, 1953. (713694.)

6013. Metro-Cutanit, Ltd.—Manufacture of commutator segments. 4th March, 1953. (713982.)

6196. British Insulated Callender's Cables, Ltd.—Variable electric resistors. 10th March, 1953. (713804.)

8012. Curtis Manufacturing Co., Ltd., and Hardy, R. G.—Electric resistors. 30th March, 1953. (713697.)

8091. C.A.V., Ltd.—A.c. generators. 12th March, 1953. (713886.)

9452. Bendix Aviation.—Rotary electri[c] switching apparatus. 15th April, 19[53]. (713994.)

9599. Radio Corporation of America.—Transistor devices. 16th April, 19[53]. (713996.)

10351. Falk, Stadelmann & Co., Ltd.—Shrouds for electrical lampholders. [16th] April, 1953. (713700.)

11703. Staatsbedrijf der Posterijen, Te[le]grafie en Telefonie.—Identification of [a] circuit of an automatic switching system [by] line identification potential marking. 8th M[ay] 1952. (713703.)

12794. General Electric Co., Ltd.—Suspended electrical busbar supports. 2[1st] May, 1953. (713892.)

14052. Revo Electric Co., Ltd.—Electr[ic] lighting fittings. 31st August, 1953. (71370[8])

14215. Soc. Anon. pour les Applicatio[ns] de l'Electricité et des Gaz Rares-Etablissemen[ts] Claude-Paz et Silva.—Method of forming [a] coating on the emissive materials of an electro[de] for electric discharge apparatus. 5th Ju[ne] 1952. (713709.)

16146. Warren, S. D., and Burkard, R. [E.] —Electrolytic capacitors. 26th June, 19[53]. (713900.)

16224. Compagnie Générale d'Electrici[té] —Device for measuring the regularity of the characteristic impedance of telecommunication cables. 27th June, 1952. (713821.)

16250. Standard Telephones & Cables, Ltd.—Electrical switching circuits employing thermionic valves. 27th June, 1952. (713902.)

16772. General Electric Co., Ltd.—Electric heating elements and apparatus incorporating such elements. 3rd July, 1953. Addition to 682697. (713712.)

19643. Exhibit Supply Co.—Hermetically sealed electric switch. 5th August, 1952. (713715.)

19795. Philco Corporation.—Cathode-ray tubes and methods of manufacturing same. 6th August, 1952. (713908.)

20473. General Electric Co., Ltd.—Crucibles. 14th August, 1952. (713716.)

21980. British Thomson-Houston Co., Ltd.—Lead-in conductors for electric lamps and the like. 1st September, 1952. (713828.)

21981. Apparatus for foliating or flattening a portion of a wire. 1st September, 1952. (713829.)

22993. Amalgamated Wireless (Australasia), Ltd.—Light amplifying cell. 12th September, 1952. (713916.)

23459. General Electric Co., Ltd.—Television apparatus. 18th September, 1952. (713921.)

23837. Philips Electrical Industries, Ltd.—Electron-optical image convertor tubes and apparatus incorporating same. 23rd September, 1952. (713924.)

24344. British Thomson-Houston Co., Ltd.—Electric-discharge lamps. 29th September, 1952. (713926.)

24979. Philips Electrical Industries, Ltd.—Methods of manufacturing electrode systems. 6th October, 1952. (713722.)

25435. Standard Telephones & Cables, Ltd.—Selenium rectifiers and method of manufacture. 10th October, 1952. (713929.)

25702. Aktiebolaget Kanthal. — Electric heating element. 14th October, 1952. (713723.)

26015. Compagnie Générale de Télégraphie sans Fil.—Television transmitters. 16th October, 1952. (713931.)

26931. Philips Electrical Industries, Ltd.—High-frequency inductance coils. 27th October, 1952. (713934.)

31716. British Thomson-Houston Co., Ltd.—Quartz-to-metal seals. 7th December, 1953. (714041.)

GENERATION AND DEVELOPMENT

Crossing the Nile by Rocket

WHERE THE Uganda Electricity Board's new 132 kV overhead transmission line, from the Owen Falls power station to Tororo, crosses the Nile, the river flows swiftly over a rocky bed. The rapids make the crossing of the river a hazardous undertaking, particularly as crocodiles abound in the waters downstream. To

Firing the Schermuly rocket from the south bank of the Nile to a promontory on the far side

establish a line of communication between the two banks of the river, the overhead line contractors, the British Insulated Callender's Construction Co., Ltd., decided to make use of a Schermuly rocket apparatus, which was obtained on loan from the port authorities at Mombasa.

In the first instance a light line, forming part of the Schermuly equipment, was fired across the river. This line was then used to draw over a 0·5in diameter manila/sisal compound rope which was made-off to a convenient tree on each side of the river with sufficient tension to keep it clear of the water. This rope has since been replaced by a stranded steel draw wire which will later be used to pull the steel-cored aluminium conductors across.

At the point of crossing the river is 1,500ft wide but the rocket was fired at an angle of approximately 30 deg to the final route to land on a promontory on the river bank—a distance of 800ft. The point from which the rocket was fired is 120ft above river level.

This is the first time that B.I. Callender's has employed Schermuly apparatus for this purpose though it has previously made use of standard coastguard rocket-firing apparatus to cross rivers and gorges.

Terms for Rural Supplies

The South West Scotland Electricity Consultative Council, at its meeting in Glasgow on 29th June under the chairmanship of Councillor J. D. Kelly, C.B.E., considered two representations in connection with the terms quoted for supplies to isolated cottages. In the two cases before the Council, capital contributions of £180 and £400 had been requested. The capital expenditures to provide supplies were £300 and £555, and the estimated annual revenues £12 and £15 respectively. The Council agreed that the terms were not out of proportion to the capital expenditures required and revenue returns. Mr. Johnston (Collin, Dumfries) suggested that it might be possible to adopt cheaper methods.

The Council examined a progress report on rural connections by the Area Board and noted that over 73 per cent of the total farms in the area had now received a supply.

Water Heater Hire

The South West Scotland Electricity Board has introduced a scheme for the hire of immersion and water heaters. The hire charges, which include plumbing work, lagging (in the case of immersion heaters) and maintenance are as follows:—Immersion heaters, 6s 6d a quarter; self-contained water heaters, 9s 6d a quarter. Both types of heaters will be equipped with thermostats. Where it is necessary to provide a special circuit, a charge of 2s 3d a quarter will be made for circuits not exceeding 15 yd in length; where the circuit exceeds that length, the consumer will be asked to pay the additional cost in one sum.

Identification of Board Employees

Mr. C. R. King, the chairman of the East Midlands Electricity Board, informed the Consultative Council at its meeting at Nottingham last week that the Board had been very much concerned on reading the many Press reports of persons falsely representing themselves to be employees of a Board or an Authority gaining admittance to premises for an illegal purpose. To assist the public in identifying the Board's employees, every member of the staff who had to call at consumers' premises had been issued with an identity card and all the Board's meter readers were being supplied with uniforms and peak caps bearing the initials E.M.E.B.

Purchase of Washing Machines

Under the Hire Purchase and Credit Sale Agreements (Control) Order, 1952, any person wishing to acquire an electric washing machine by hire-purchase or credit sale has to make a first payment of at least one-third of the aggregate of the cash price and any maintenance and installation charges if payable by instalments. In addition, the balance must be paid over a period not exceeding eighteen months. At last week's meeting of the East Midlands Electricity Consultative Council it was pointed out that as these machines cost from about £35 upwards, a great many families are unable to afford either the large initial down payment, or the periodical instalments. Lady members of the Council felt that in view of the labour saving advantages of these machines to the average housewife, they should be regarded as necessities and excluded from the scope of the Order. This would make it possible for such appliances to be offered to the public on a long-term hire-purchase basis with instalments scaled down to suit the weekly budgets of those families in the lower income groups. The chairman of the Council was authorized to press for the exclusion of washing machines from the Order on every suitable occasion.

Large Italian Waterwheels

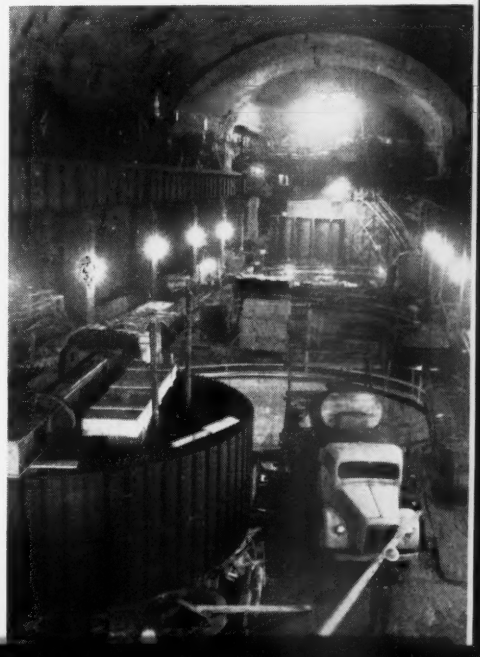
For the Cimego hydro-electric power station of the Societá Elettrica Bresciana (Italy), Ercole Marelli & Co., Milan, are manufacturing two 110,000 kVA water-wheel alternators which are believed to be the largest horizontal units yet built. Each machine is driven at 300 r.p.m. by two 75,000 h.p. overhung Pelton turbines at each end, and has a weight of 650 tons.

The Cimego project is being developed by the Direzione Costruzioni Impianti Idroelettrici, a subsidiary of the Edison Group of Milan, which is responsible for planning and supervising the construction of works of this kind.

New Swedish Station

Sweden's second largest power station, the Kilforsen plant, with a total capacity of 285,000 kW, was officially inaugurated recently by Prince Bertil. The station ranks next to the 375,000 kW Harsprånget plant above the Arctic Circle and will form a vital link in the chain of stations feeding into the Swedish 380 kV transmission network. Kilforsen is named after one of the nine rapids in the lower part of the Fjällsjö river, a tributary of Ångermanälven. The scheme for harnessing the power of these rapids (total head 324ft) entailed diverting the water from the old river bed along a stretch of some 12 miles and creating a short cut to the Angerman river. The first part of the diversion is through a canal and thence by way of a tunnel 42ft wide and 56ft high blasted through the solid rock. This tunnel is claimed to be the largest of its kind in the world. Provision has had to be made for floating timber and a travelling motor-driven platform has been installed so that a constant watch can be kept in order to prevent congestion of logs within the tunnel. The project has cost altogether £28 million. The power plant comprises three Francis turbines driving A.S.E.A. generators.

One of the generators in course of erection at Kilforsen



CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—ADELAIDE.—20th August. Electricity Trust of South Australia. Water softening units and central evaporating plant for Port Lincoln power station. (See this issue.)

3rd August. 33/11 kV delta/star three-phase transformers. (E.S.B. 15844/54. Ten/9739.)*

MELBOURNE.—3rd August. Department of Works. Power switchboard. (E.S.B. 16006/54. Ten/9777.)*

Belfast.—29th July. Corporation Electricity Department. One 4-ton mobile crane. (See this issue.)

19th July. Northern Ireland Hospitals Authority. Electrical installation in Purdysburn Hospital. Chief engineer, Victory Buildings, 44–46, Queen Street.

Canada.—WINNIPEG.—20th July. 500 kVA turbo-generator unit. (E.S.B. 16460/54. Ten/9832.)*

Formosa.—TAIPEI.—30th July. Taiwan Power Co. Automatic combustion control system for two steam generating units supplying a 38,000 kW turbo-generator. (E.S.B. 15912/54. Ten/9752.)*

9th August. Central Trust of China. Amplifier and speaker sets, telephone equipment, etc., for train dispatching. (E.S.B. 16524/54. Ten/9826.)*

Hatfield.—21st July. R.D.C. Street lighting equipment. (See this issue.)

India.—BANGALORE.—16th July. Stores Purchase Committee, Government of Mysore. Magnetic telephones and accessories. (E.S.B. 15889/54. Ten/9746.)* 26th July. Power service meters. (E.S.B. 15907/54. Ten/9773.)*

NEW DELHI.—20th July. Director General of Supplies and Disposals. Two electrically-operated automatic mechanical plants with chain conveyors. (E.S.B.15887/54. Ten/9747.)*

29th July. Vacuum impregnating plant. (E.S.B. 15553/54. Ten/9690.)*

BIHAR.—30th July. Government Electricity Department. Twenty power transformers of from 100 to 1,500 kVA capacity. (E.S.B. 16564/54. Ten/9827.)*

Kidderminster.—9th August. Corporation. Electrical installations in the retail market. (See this issue.)

Romford.—14th July. Corporation. Electrical installations in 46 flats. (See this issue.)

Slough.—16th July. Corporation. Submersible electrically driven pumping unit. Borough surveyor, Town Hall.

South Africa.—JOHANNESBURG.—22nd July. South African Railways. One 150 MVA, 400 A, 6·6 kV oil circuit breaker, one 6·6 kV/400 V, 500 kVA, three-phase transformer and two 400 V distribution boards. (E.S.B. 15699/54. Ten/9720.)*

4th August. Private automatic exchange and ironclad telephones. (E.S.B. 16379/54. Ten/9818.)*

5th August. Radio-telephone equipment. (E.S.B. 16348/54. Ten/9798.) Electrical insulating material. (E.S.B. 16349/54. Ten/9804.)*

Sunderland.—23rd July. Corporation. Electrical installation at the Hylton Red House Infants' School. Borough architect, Grange House, Stockton Road.

United States. — DENVER. — 20th July. U.S. Bureau of Reclamation. One 15 kV, 10,000 kVA voltage-regulating transformer. (E.S.B. 15972/54. Ten/9749.)*

Uruguay.—MONTEVIDEO.—17th August. Usinas Electricas y los Telefonos del Estado. 8,000 h.v. insulators. (E.S.B. 16019/54. Ten/9768.)*

Wandsworth.—21st July. Borough Council. Street lighting equipment. (See this issue.) 140 W sodium lamps and jackets. (See this issue.)

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberavon.—Switchgear house for new gasworks; Wales Gas Board, Grangetown, Cardiff.

Bedford.—First portion of North Bedfordshire College of Further Education; county architect, Bedford.

Belford.—Houses (23); R.D.C. surveyor, 1, High Street.

Biddulph.—Development of estate at Park Lane for municipal buildings, shops, cinema, health centre, etc.; U.D.C. surveyor, Council Offices, High Street.

Birmingham.—Large number of houses, shopping centre and branch technical college on Holifast Grange estate, Erdington; A. G. Sheppard Fidler, city architect, Civic Centre, 1.

Bournemouth. — Rebuilding Memorial Methodist Church, Exeter Road (£65,000); Frederick Lawrence & Partners, architects, 93, Southbourne Road, Southbourne, Bournemouth.

Bradford.—Villa for 40 patients, Westwood Hospital, Clayton Heights; Leeds Regional Hospital Board, Park Parade, Harrogate.

Brighton.—Factory for New Welbeck, Ltd., and R. J. Adcock & Co., Ltd., at Moulsecomb Way; A. Cruttenden & Sons, Ltd., 60a, Beaconsfield Road, Brighton

Factory at Hollingbury Light Industrial area for Henry Clark & Sons, Ltd.; Jeffery & Sons (Hove), Ltd., 206, Portland Road, Hove 3.

Bristol.—Works; Rouch & Renny, 8, Old King Street.

Chelmsford.—Offices; J. W. Coward & Co., Ltd., 101, Lower Anchor Street.

Doncaster.—Martin Junior Mixed School, Intake estate; Education Committee's architect, Doncaster.

Easington.—Proposed pavilion at Crimdone Dene (£76,000); R. R. Lumsden, surveyor, Rural District Council Offices, Easington, Co. Durham.

New stores at Wheatley Hill for Sherburn Hill Co-operative Society, Ltd. (£30,000); C.W.S. Architects' Dept., 90, Westmorland Road, Newcastle-on-Tyne.

Enfield.—Flats (60), London Road and Lincoln Road; U.D.C. surveyor.

Eston.—Cinema (983 seats), Grangetown, for P. Lanny; Garbutt, Archibald & Archibald, architects, 23, Albert Road, Middlesbrough.

Hendon.—Moat Mount secondary school (£200,455); Middlesex county architect, 10, Great George Street, S.W.1.

Houghton-le-Spring.—Y.M.C.A. premises at Fence Houses; S. W. Milburn & Partners, architects, 9, Esplanade, Sunderland.

Ilkley.—Two 40-patient villas, Scalebor Park Hospital, Burley; R. B. Armistead, architect, 10, Booth Street, Bradford.

Littlehampton.—Factory; A. Cruttend[en] & Sons, Ltd., 60, Beaconsfield Road, Brighto[n]

London.—HAMPSTEAD.—Dwellings (1[9]), Finchley Road and Harben Road; Norm[an] & Dawbarn, architects, 5, Gower Street, W[C].1.

Maidenhead.—Old people's hostel on [the] Larchfield estate (£40,000); J. T. Ca[rr]le, Berkshire county architect, Wilton Ho[u]se, Parkside Road, Reading.

Maidstone.—Wholesale sales depot in [Mil]lgate Street; Swift & Co., Ltd., meat impor[ters], 58, West Smithfield, E.C.1.

Manchester.—Eight-storey office bloc[k] at Oxford Street for Tootal Broadhurst Le[e] & Co., Ltd.; John E. Beardshaw & Partn[ers], architects, 186, Oxford Road, Manchester.

Rebuilding office block at Trafford P[ark], for Massey Harris, Ltd.; Neodox, L[td.], Atlantic Chambers, Brazennose Street, M[an]chester.

Extensions to factory at Manor Road [and] Lonsdale Road, Levenshulme, for Cli[ff]on Chocs, Ltd.; A. Roland Walsingham, archit[ect], 6, Ashfield Road, Cheadle, Ches.

Middlesbrough.—Houses (1,000), Eas[t]-side Road area; J. A. Kenyon, borough [en]gineer.

Mid-Warwicks.—New Leamington Col[le]ge for Girls (£168,000), county junior schoo[l] at Whitnash, R.C. secondary school at Leamington, and additions to Leamington College for Boys (£60,000); G. R. Barnsley, county architect, Shire Hall, Warwick.

Newcastle-on-Tyne.—First stage (estimated cost £461,000) of proposed new municipal offices at Barras Bridge; city architect, 18, Cloth Market.

Northumberland.—Pithead baths at Pegswood Colliery for the N.C.B. (£50,000); George Henderson, builder, East Boldon, Co. Durham.

Peterborough.—Alterations to St. John's Hospital (£35,000–£40,000); East Anglian Regional Hospital Board, Cambridge.

Plaistow. — Factory; Whitefields, Ltd., Tunmarsh Lane.

Reading.—Factory, Manor Farm estate; Chr. Hansen's Laboratory, Ltd., Ronson House, Strand, W.C.2.

Stockton-on-Tees.—Electrical installations in 12 houses, Grangefield Road; borough architect, 28, The Square.

Upholland.—Council offices; U.D.C. surveyor.

Waltham.—Fire station; county architect, Lincoln.

Warwick.—Development of Percy housing estate at Guy's Cliffe (£1,250,000); Jackson & Edmonds, architects, 116, Colmore Row, Birmingham, 3.

Council chamber; G. R. Barnsley, county architect, Shire Hall, Warwick.

Wem.—Houses (60), Shawbury; Hind & Brown, architects to R.D.C., District Bank Chambers, Hanley, Stoke-on-Trent.

West Bromwich.—Extensions to works in Albion Road; Fordath Engineering Co., Ltd., Hamblett Works.

Weston-super-Mare.—Fire station and divisional headquarters (£52,000); R. O. Harris, Somerset county architect, Park Street, Taunton.

Eight-classroom extension at Grammar School; Kenneth Nealon, architect, 28, Orchard Street, Bristol, 1.

Weybridge.—Flats (54), Brooklands Road; surveyor to Walton and Weybridge U.D.C.

Whitehaven.—Area administrative offices (£50,000); county architect, Carlisle.

Wimbledon.—Large factory, Wandle Park House site; Connolly Bros. (Curriers), Ltd., leather manufacturers, 39, Chalton Street, Euston, N.W.1.

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* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

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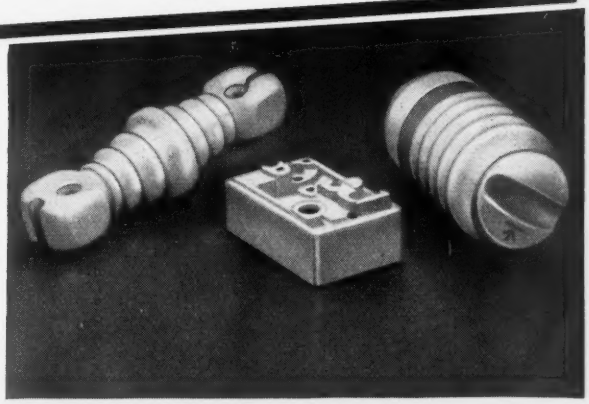

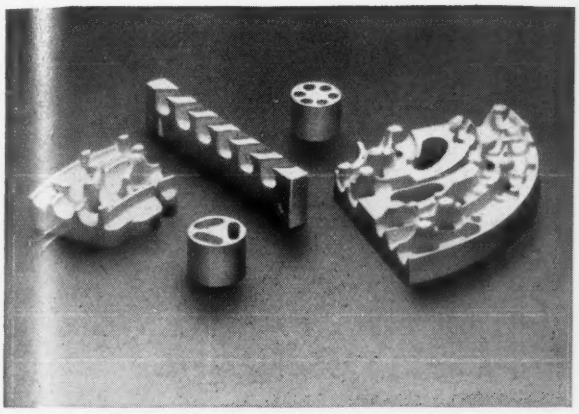

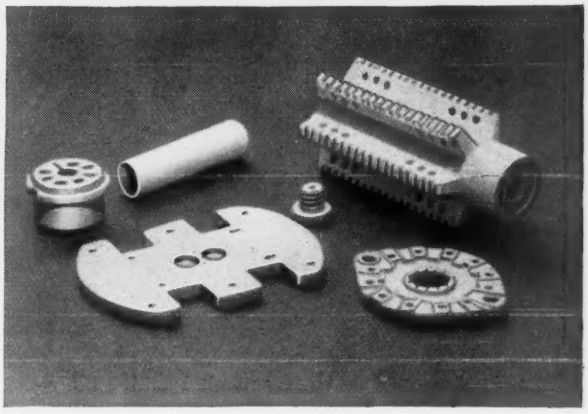

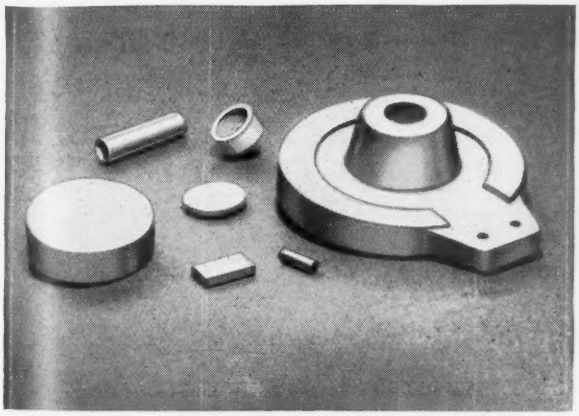

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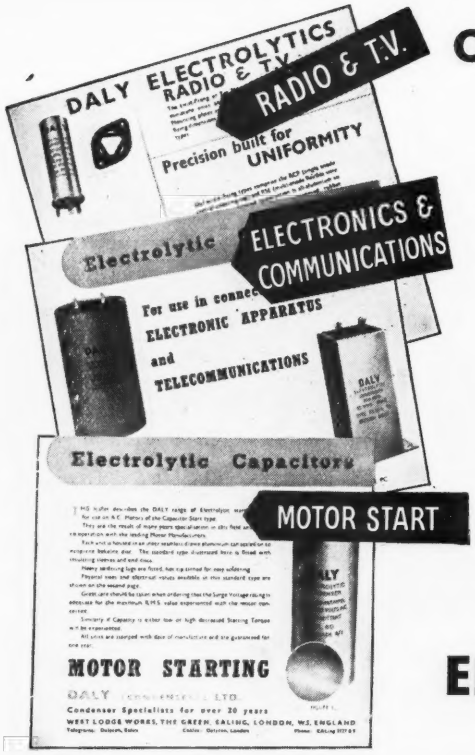

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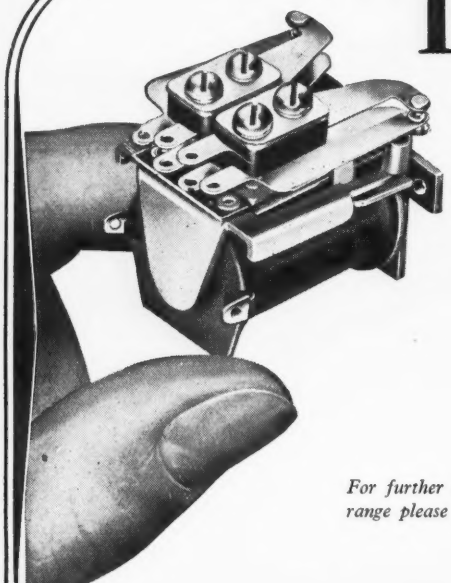

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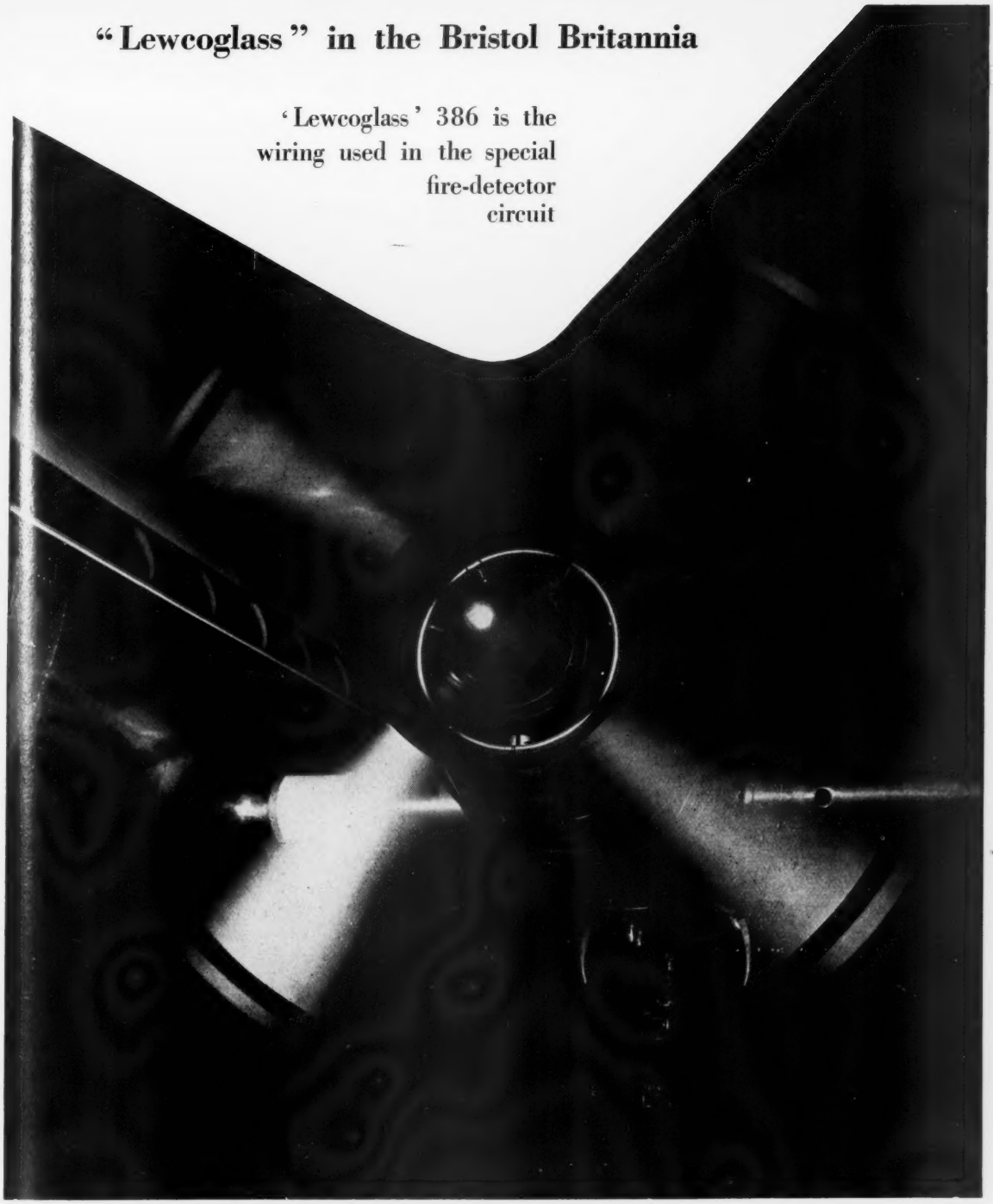
"Lewcoglass" in the Bristol Britannia

'Lewcoglass' 386 is the wiring used in the special fire-detector circuit



'Lewcoglass' 386, a silicone bonded, glass braided and taped, tinned copper flexible, has the approval of the Ministry of Supply, Air Division, to their specification EL 1736. This type has been designated by them Unifiredet 7. Technical information and data available upon request.

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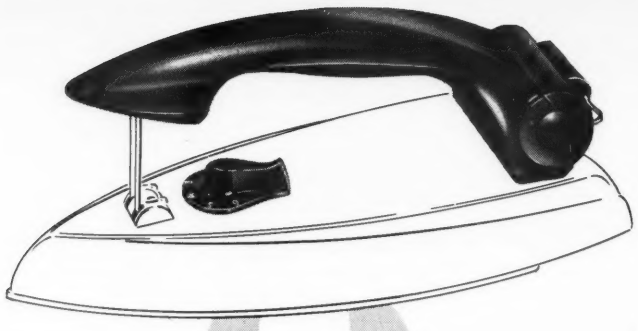

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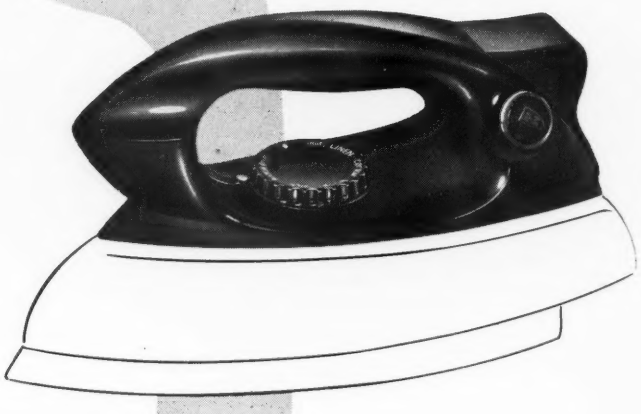

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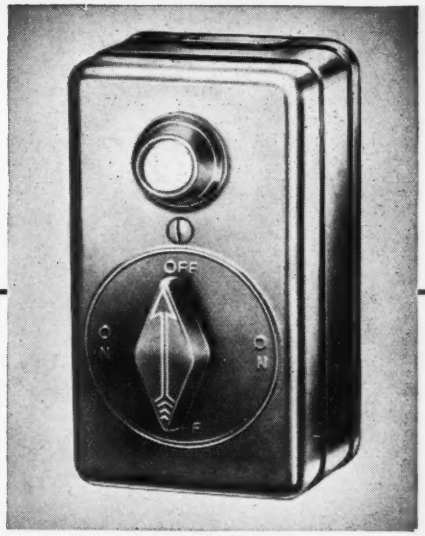

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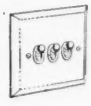
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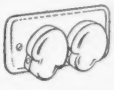
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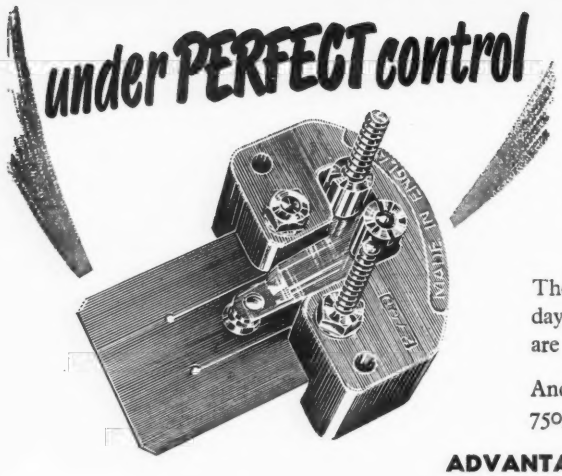

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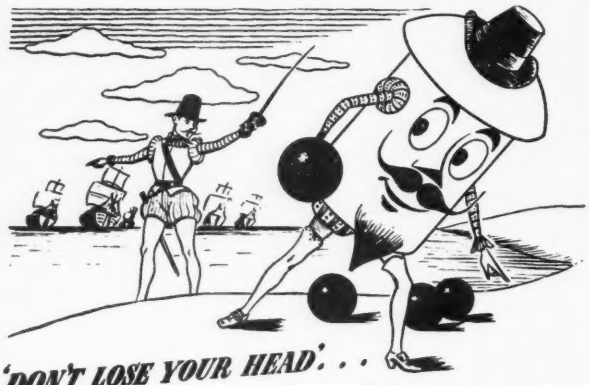

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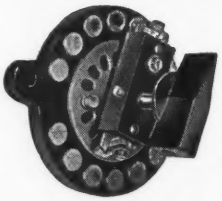

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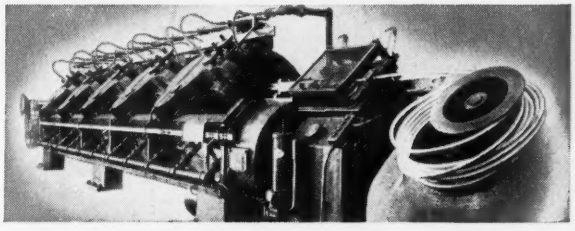

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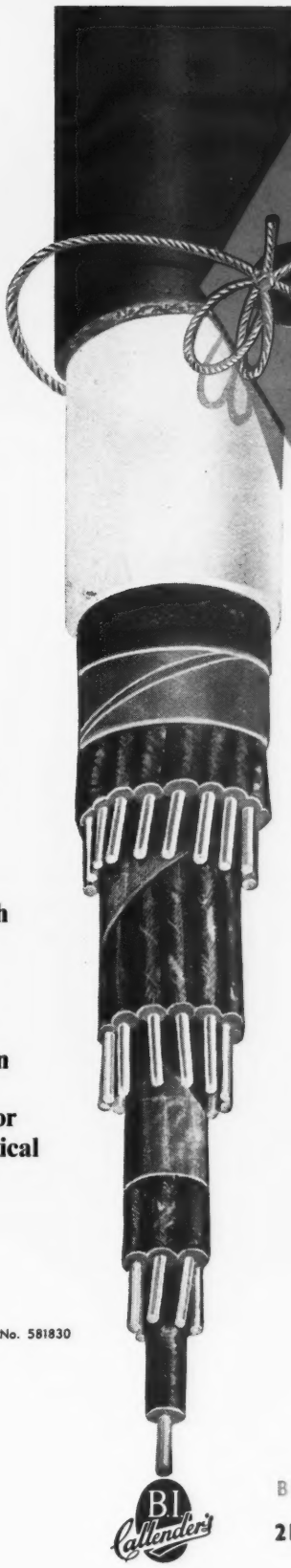

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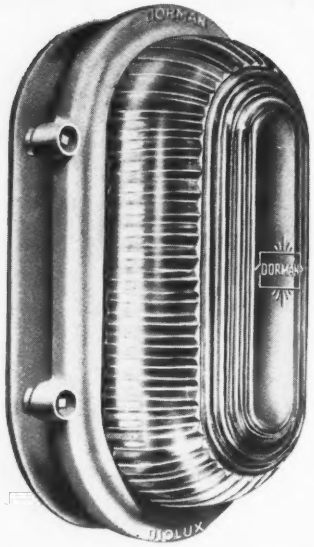

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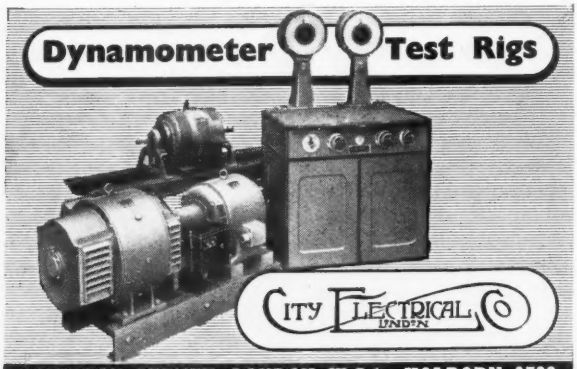

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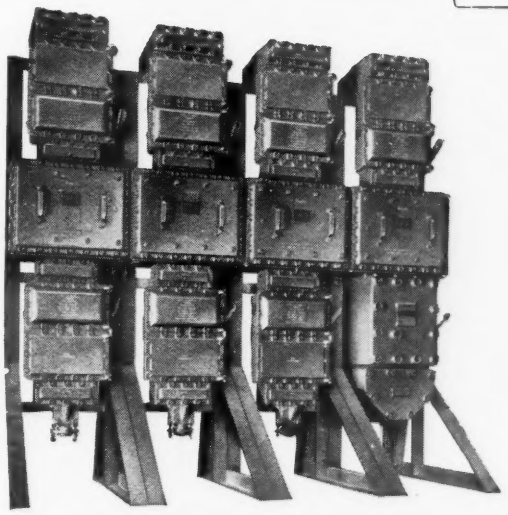
Simplex

Flameproof FLP Equipment



Here is a typical Simplex Flameproof switchgear panel as supplied to oil companies throughout the world. This panel has 300 amp, 500 volt T. P. & N. busbar chambers, 200 amp, 500 volt incoming T. P. & N. switch and seven 60 amp, 500 volt T. P. & N. outgoing switchfuses. This panel was supplied to E. B. Badger & Sons Ltd., of Parkgate Road, Battersea, for the Anglo-Iranian Oil Company's new refinery at Aden

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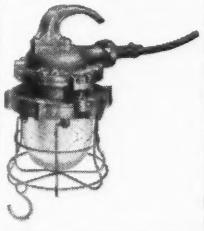

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Simplex offered the first and only Flameproof Handlamp (40-60 watt) ever to be granted a full Ministry of Fuel and Power Certificate (No. 3139, covering Groups II and III Gases). The handlamp—which can be supplied ready wired—is designed for use with a special cable and can be wired in conjunction with the Simplex Interlocking Switch Socket and Plug

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Advisory Centre We will be very pleased to help solve any problems involving Flameproof equipment. Write to our Flameproof Equipment Advisory Centre, Broadwell Works, Oldbury, Birmingham

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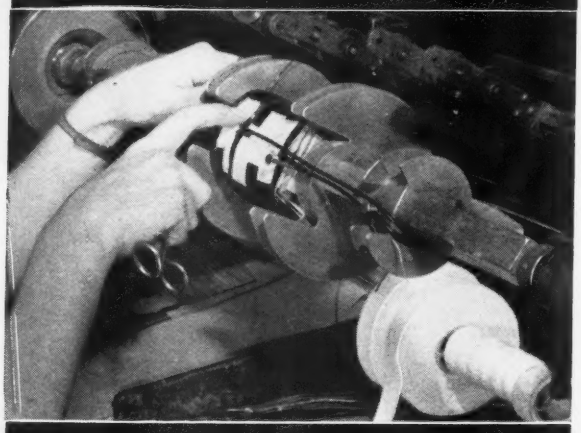

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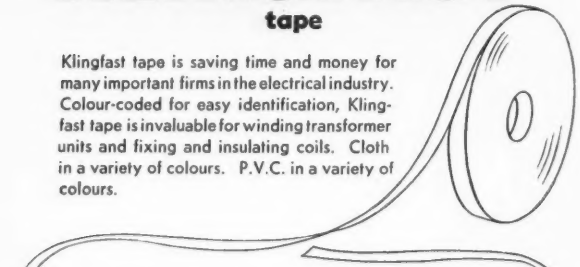

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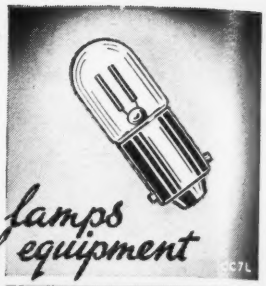
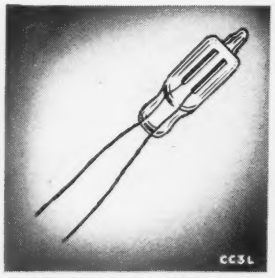
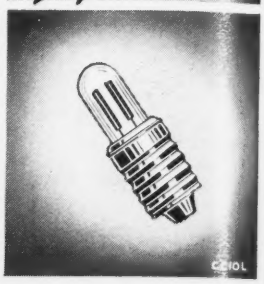


Neon indicator lamps for electrical equipment





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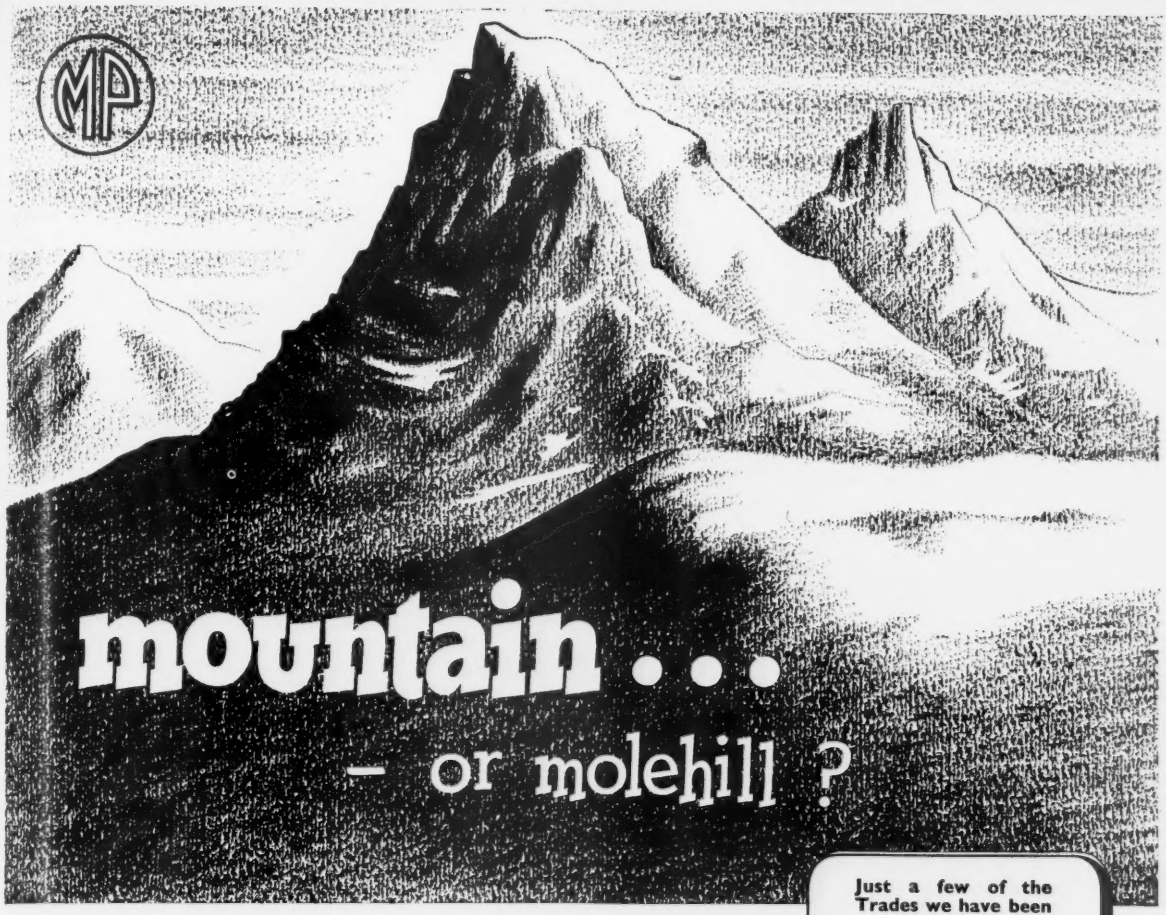

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C.38

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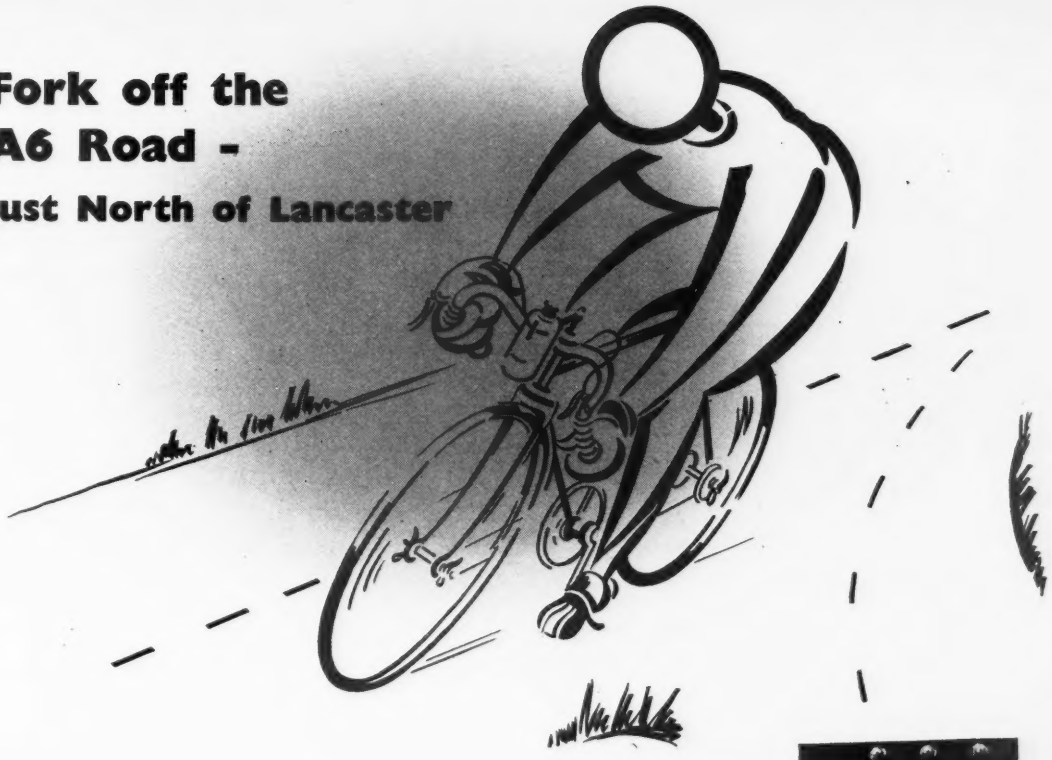

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For Reliable Electrical Control

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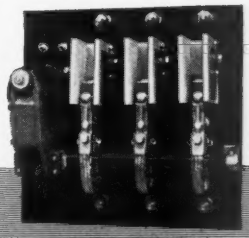

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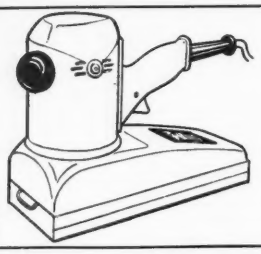

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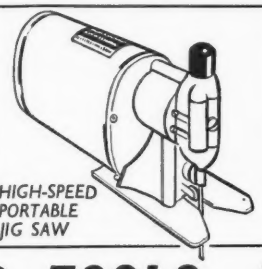

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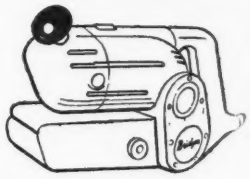

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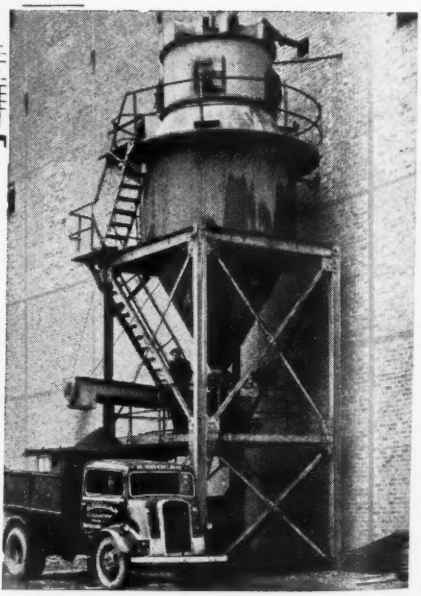

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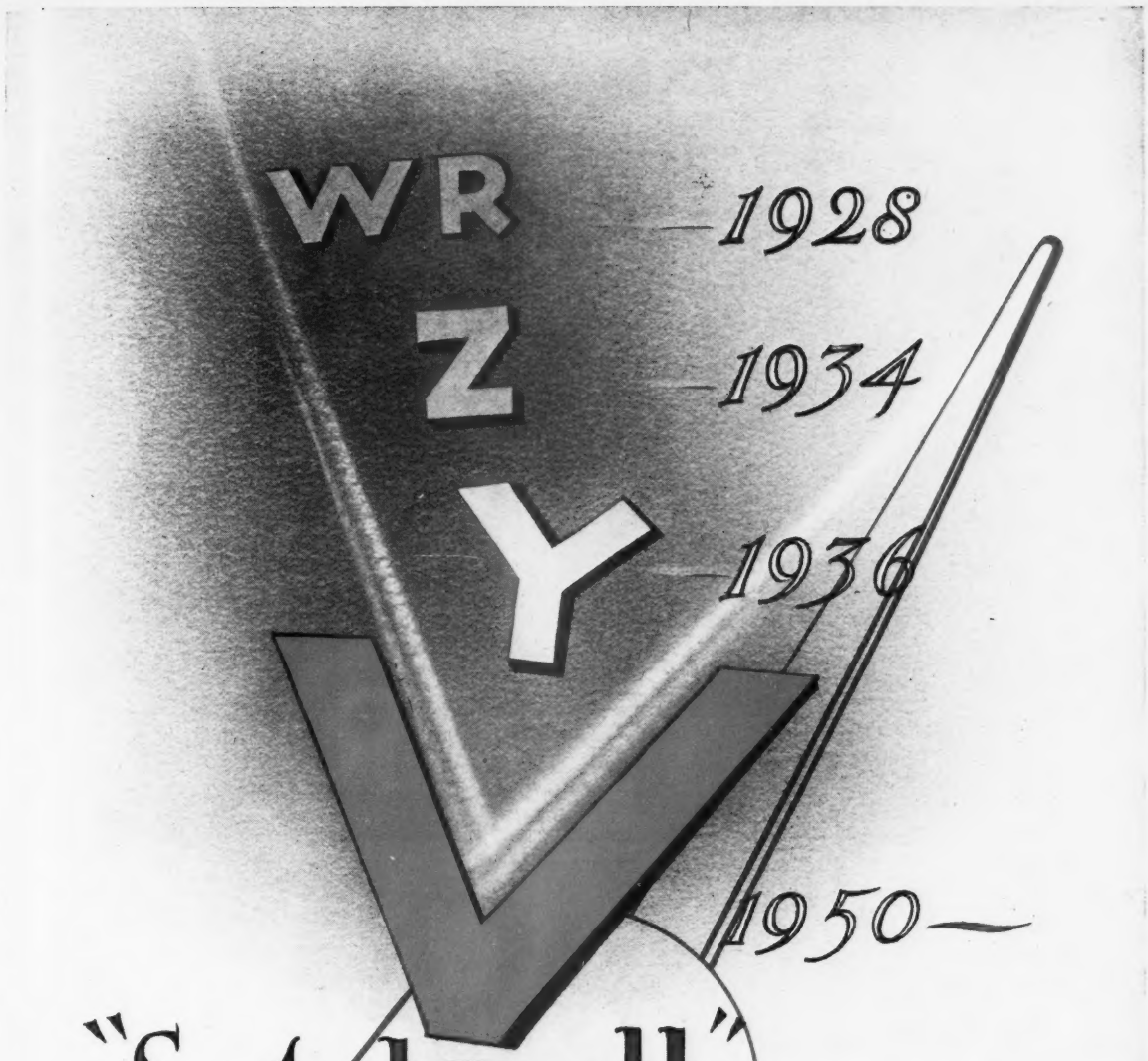

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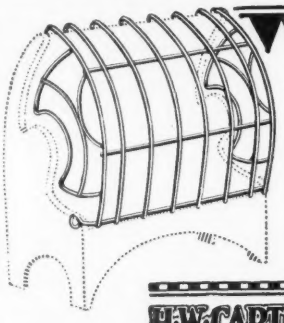

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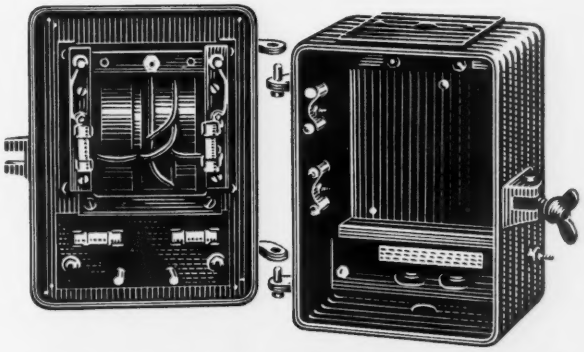

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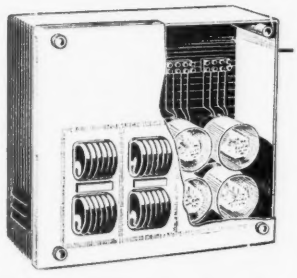
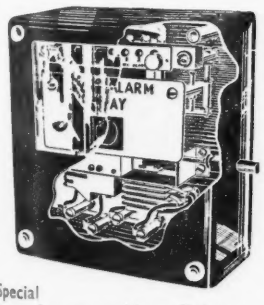


Illustrated above is an 8-point Lamp Indicator Box.



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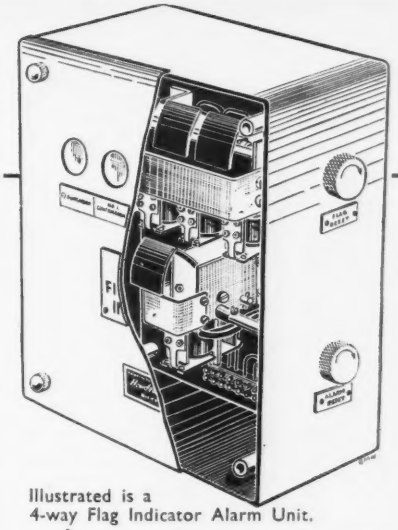

Illustrated is a 4-way Flag Indicator Alarm Unit.

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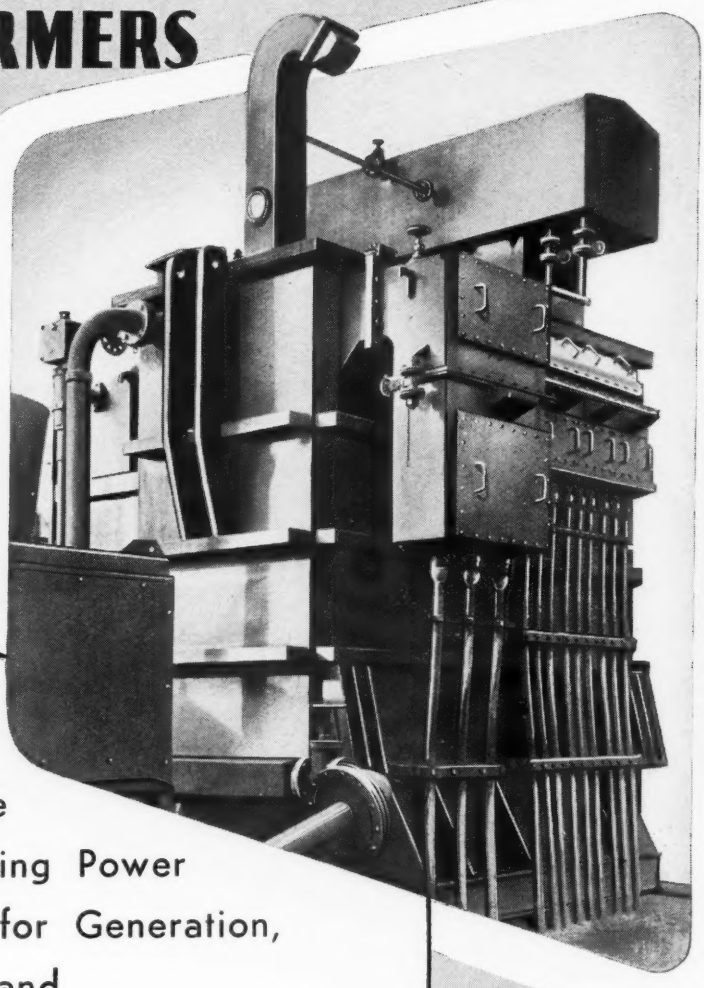

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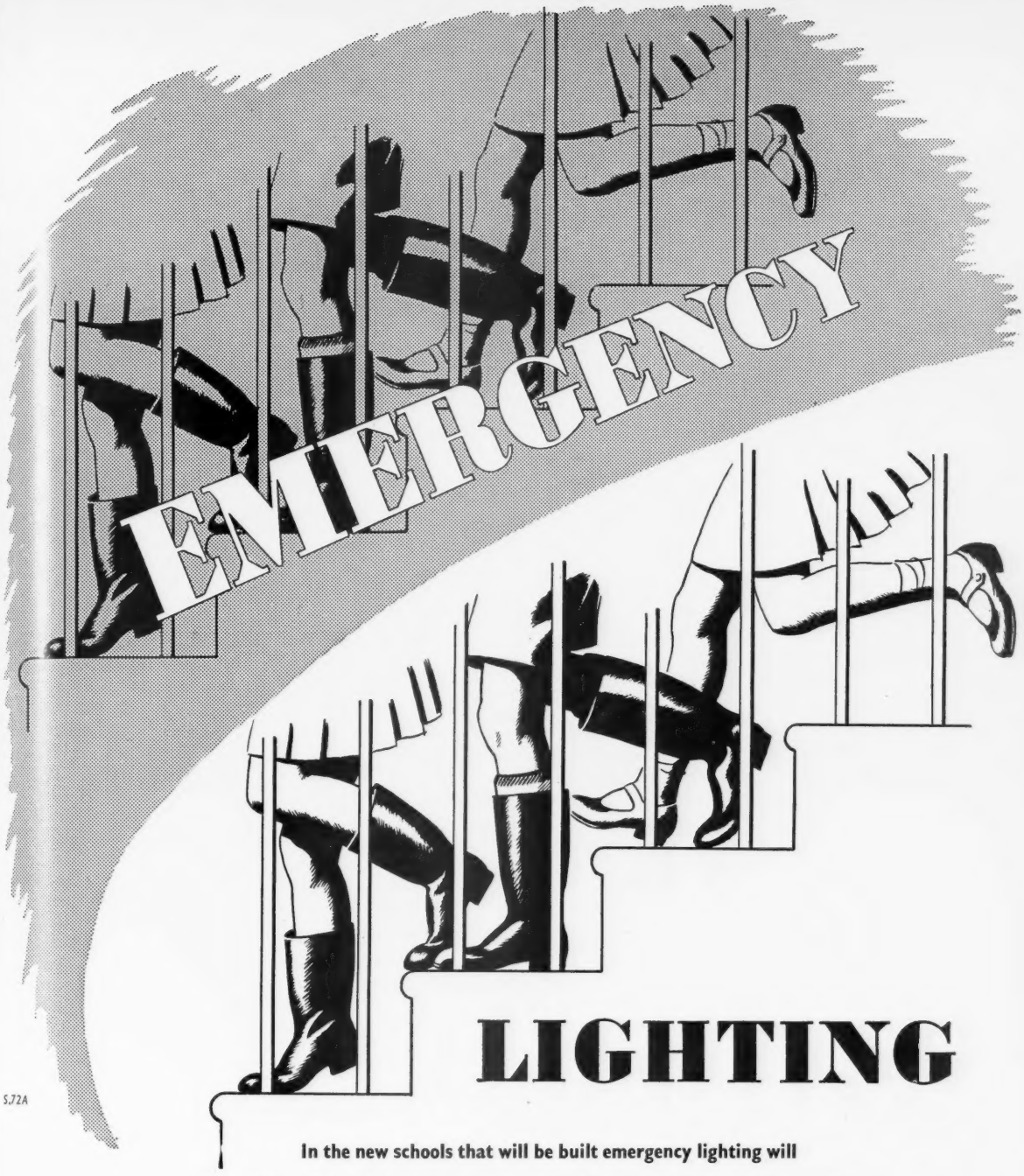

LIGHTING

S.72A

In the new schools that will be built emergency lighting will be installed. Not, it is hoped, as an afterthought. The installation of the standby system which guards against all the risks of mains interruption should be planned at the same time as the main lighting is planned. Chloride Batteries Limited, makers of Keepalite, the automatic emergency lighting system, offer the advisory services of their engineers to architects and electrical contractors in any part of Britain.

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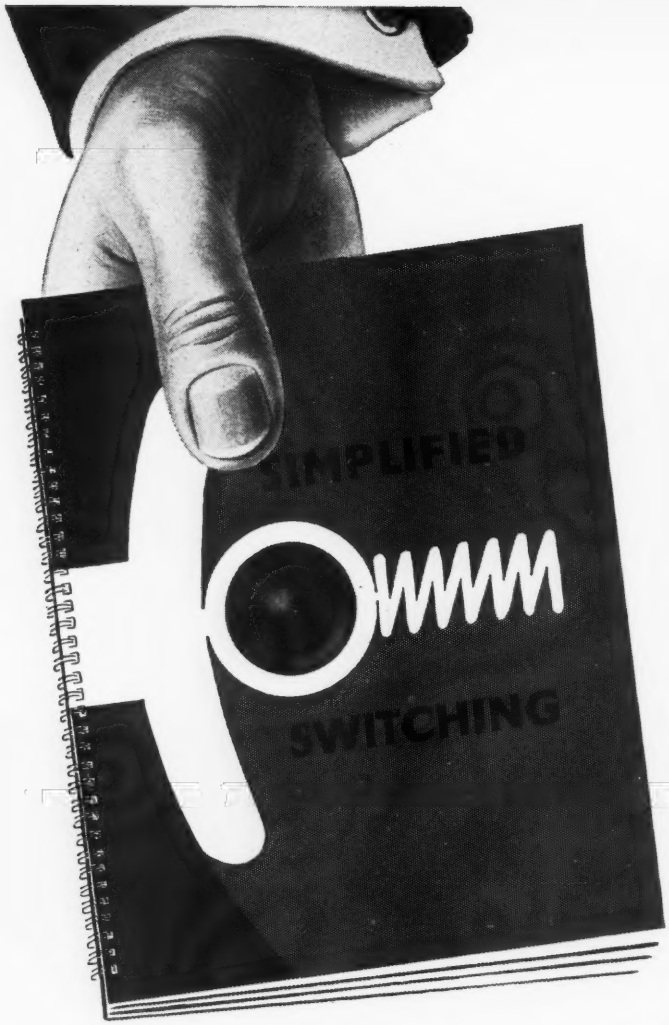

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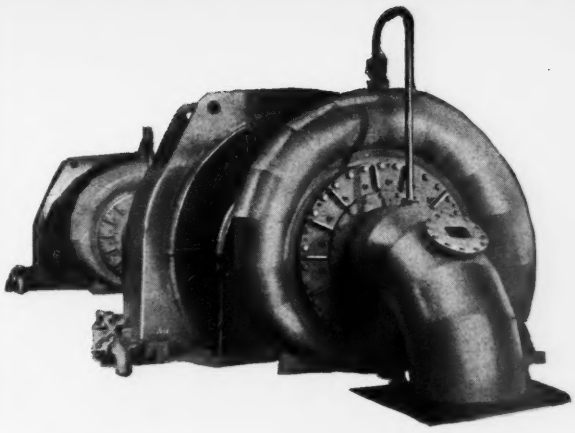

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P36

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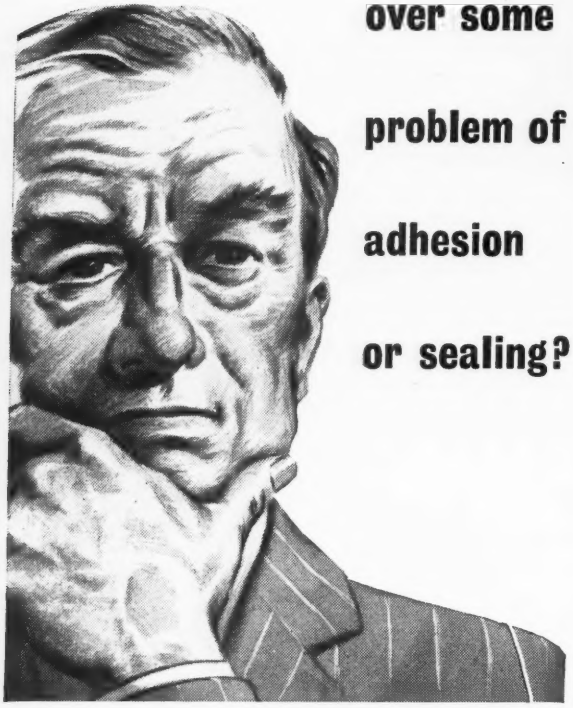

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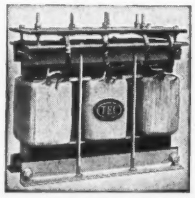

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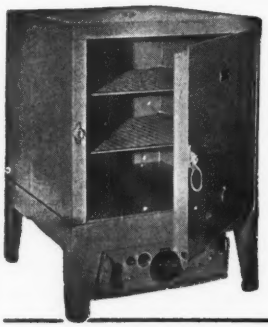

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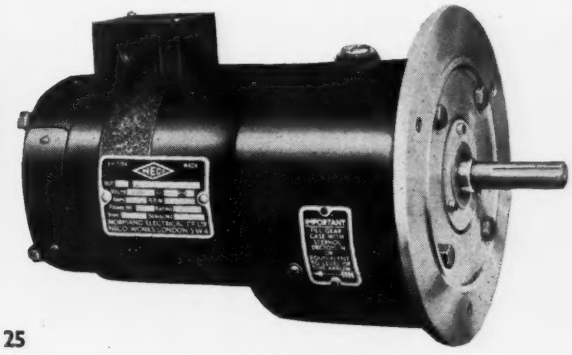

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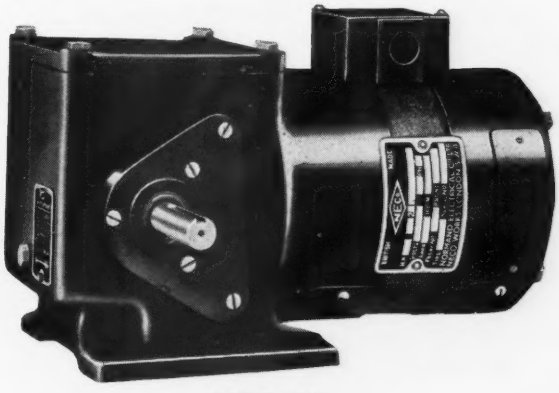
NECO geared motors with outputs up to 1500 lb.ft. NECO ungeared motors up to 5 H.P.



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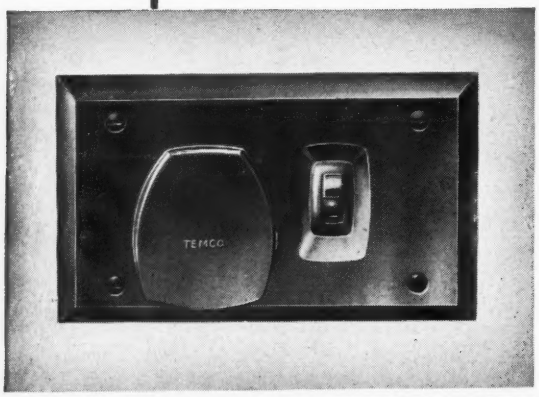

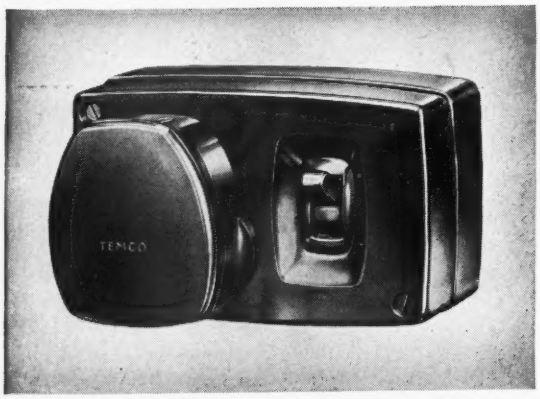

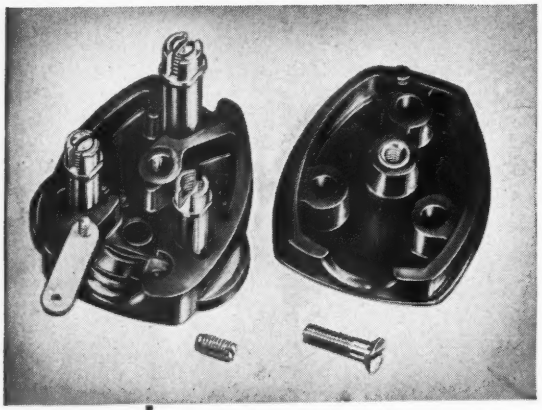

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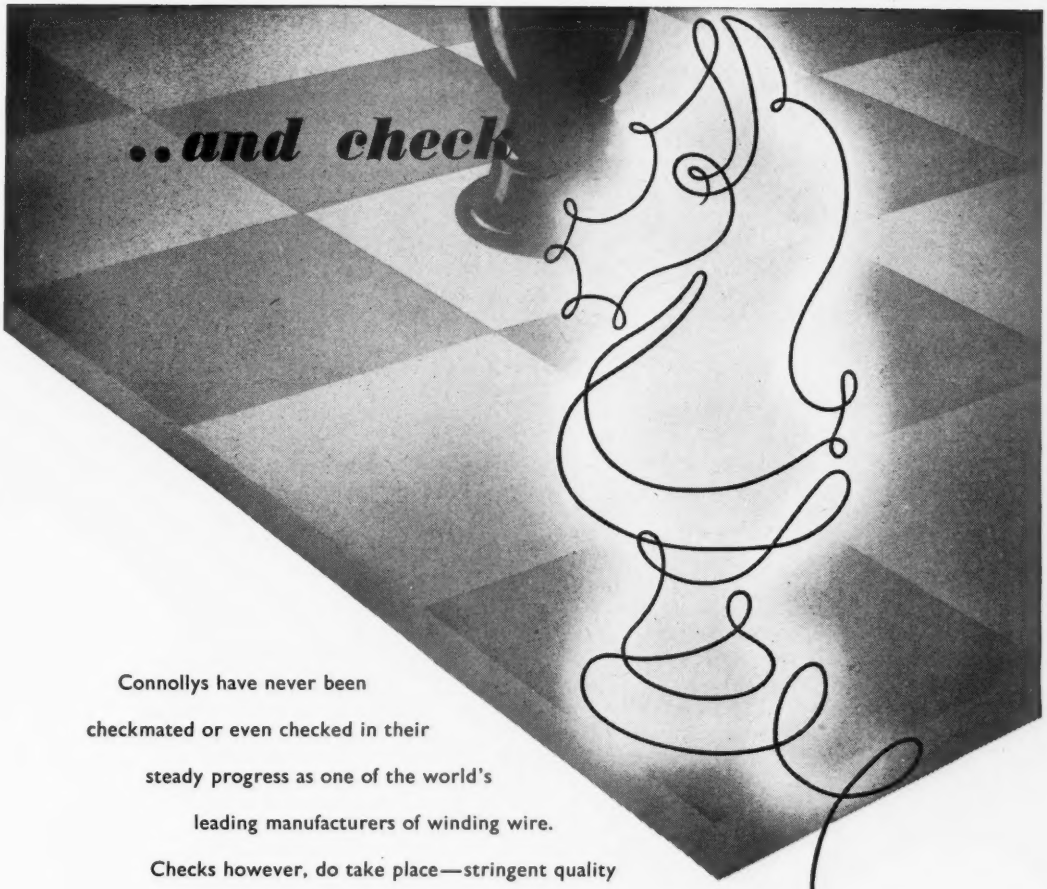

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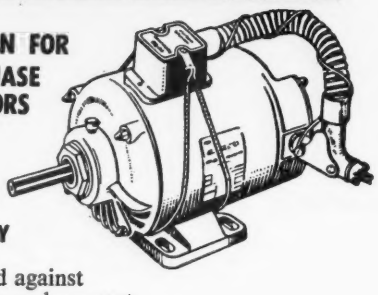

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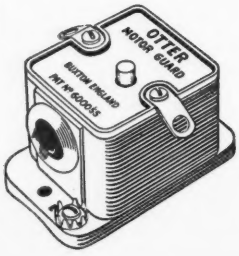

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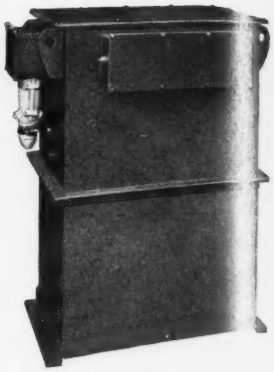

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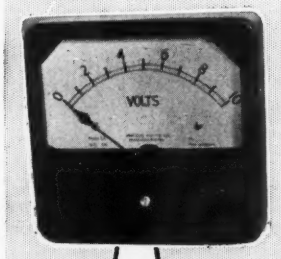

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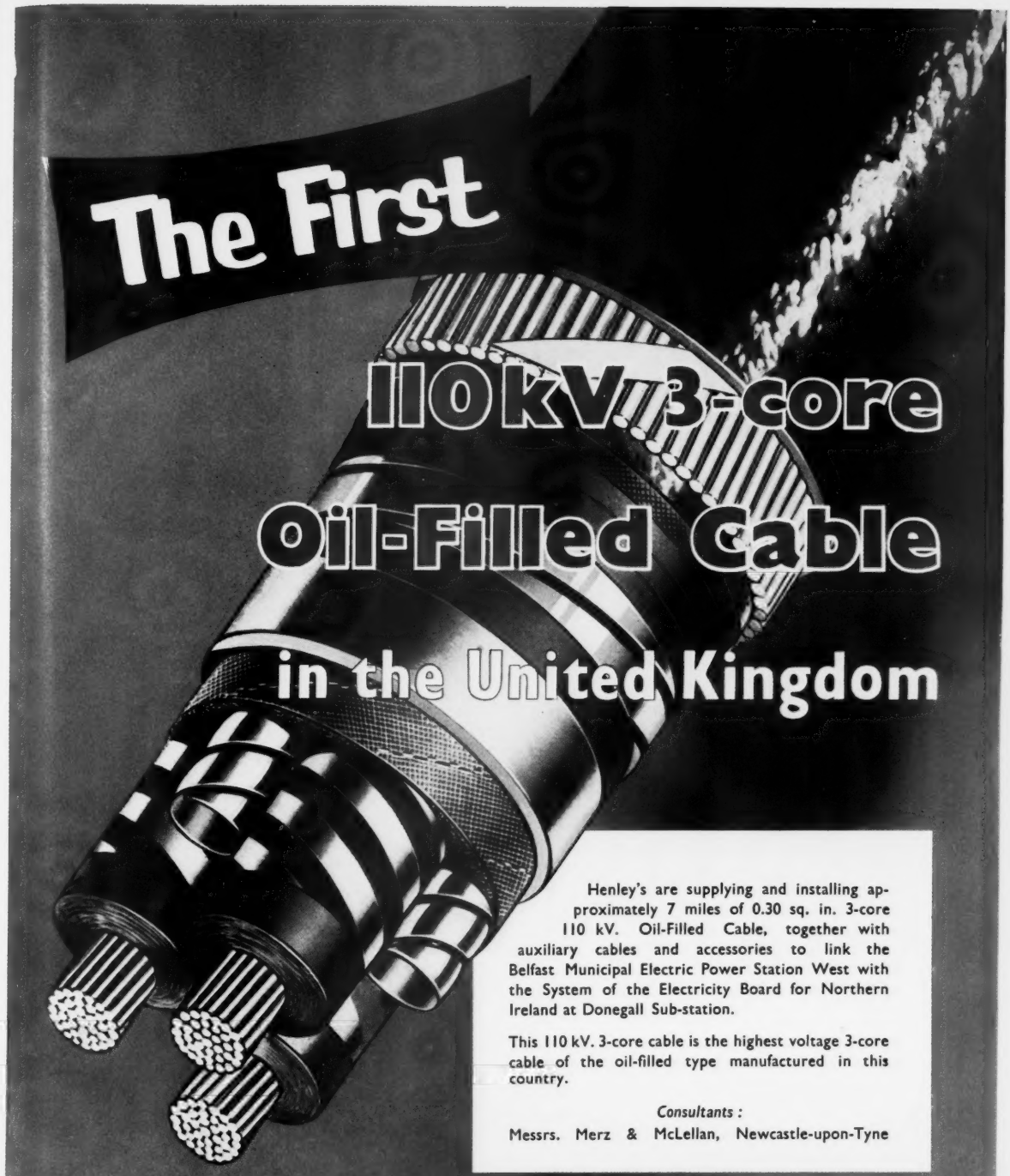

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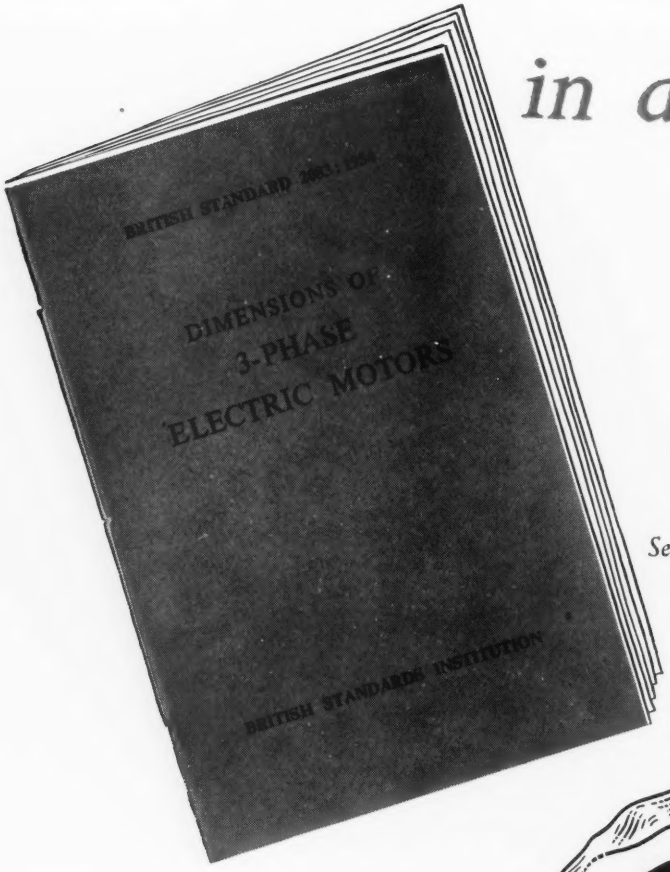

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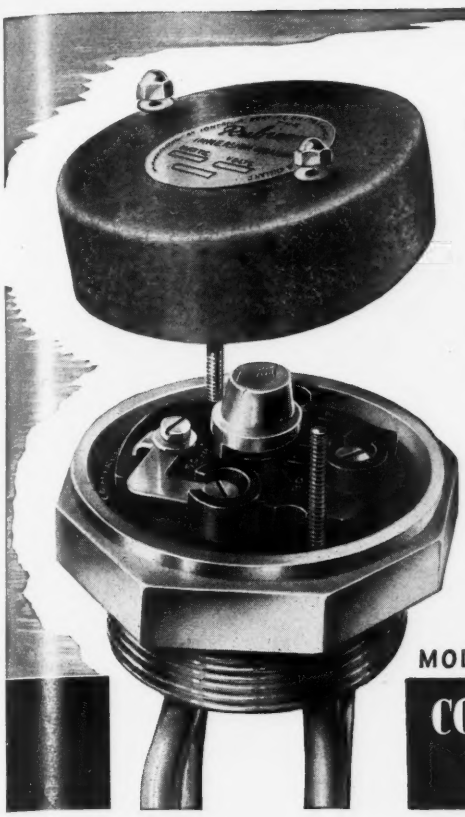

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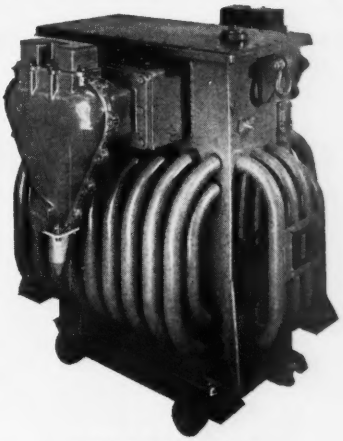

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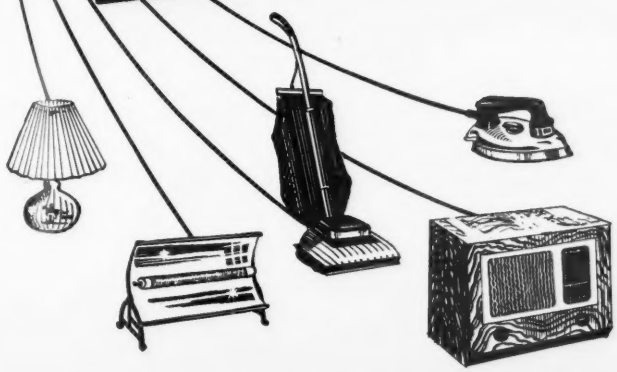

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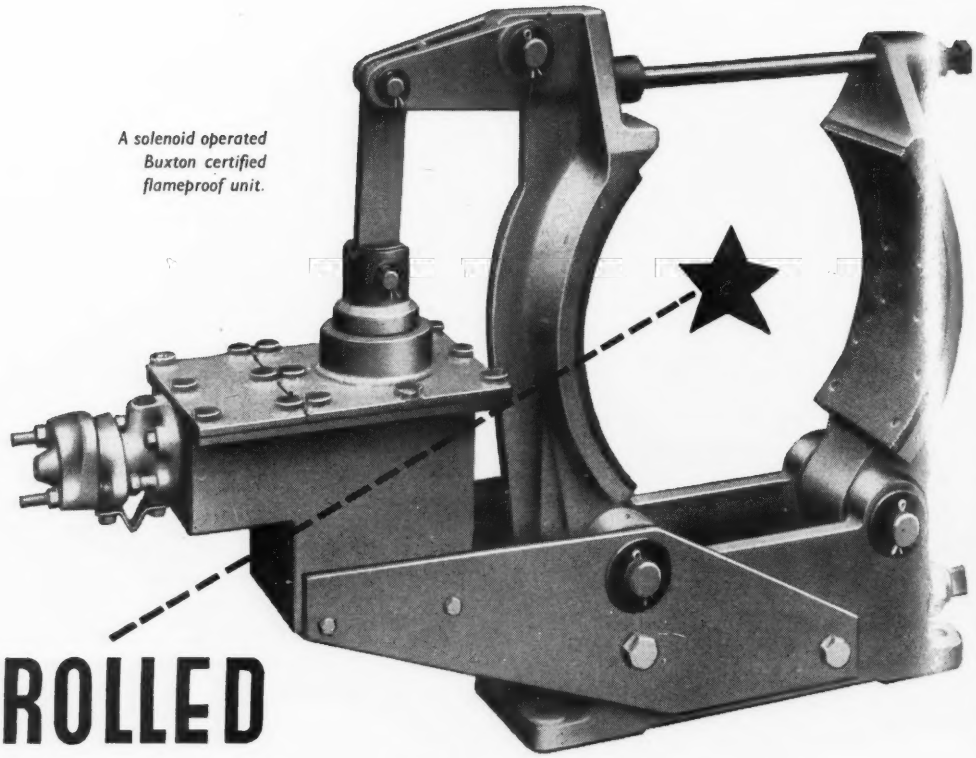

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THE MERCURY SWITCH MANUFACTURING COMPANY LIMITED are the largest specialised manufacturers of Mercury Switches in Great Britain. These are made to exceptionally high and uniform standards of quality.
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THE MERCURY SWITCH MANUFACTURING COMPANY LIMITED
WEST DRAYTON • MIDDLESEX

MS12

SMOKE

RADIOVISOR
EST. 1927

SMOKE DENSITY RECORDERS

The agreed first essential for smoke-controlled combustion

Used by leading Industrial Companies for the past 25 years

Public opinion is now demanding Government action for diminution of smoke. A fuel burning plant should *not* make excessive smoke if it be fired correctly. The Radiovisor Smoke Density Indicator operates during the whole 24 hours. It indicates and records the density of smoke emitted and shows the operator when attention is needed. In addition, an accurate record is available showing if efficient combustion with the minimum of smoke is being maintained and the Management have evidence *to prove* they are not contributing to air pollution.

There is a range of standard equipment to cover all sizes and types of installations.

Further particulars from :

RADIOVISOR PARENT LTD

THE FIRST NAME IN PHOTO-ELECTRIC CONTROLS

1 STANHOPE STREET, LONDON, N.W.1

Telephone : EUSton 5905/6

Other RADIOVISOR PHOTO-ELECTRIC & ELECTRONIC CONTROLS include:

FLAMESTAT FLAME FAILURE CONTROL · HOPPER & BUNKER LEVEL CONTROL
SMOKE ALARM · PRINT REGISTRATION
SMOKE DETECTOR FIRE ALARM · PHOTO-ELECTRIC SAFETY GUARD
COUNTING & BATCHING UNIT · FACTORY LIGHTING CONTROL
INVISIBLE RAY BURGLAR ALARM · AUTOMATIC RADIATION PYROSTAT
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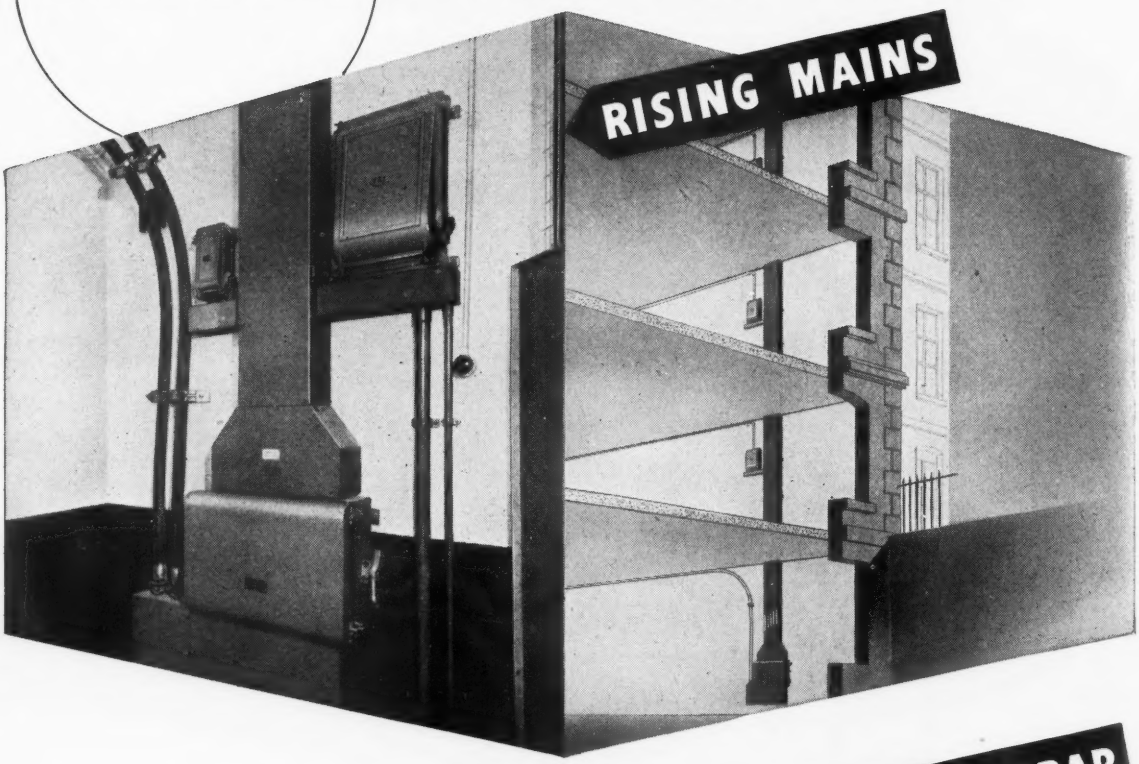
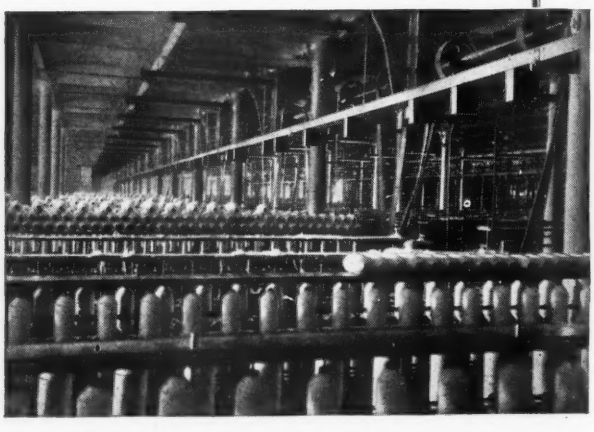
INDUSTRIAL METALCLAD DISTRIBUTION SYSTEMS





THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue, and should be addressed to Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

CLASSIFIED advertisements are PREPAID at 3/- per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number this counts as two words and carries an additional charge of 1/-.

DISPLAYED:—£2 per inch, per insertion. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

ELECTRICITY (ESSENTIAL SUPPLIES) ACT (NORTHERN IRELAND), 1954

CITY & COUNTY BOROUGH OF BELFAST

Electricity Department

TENDERS are invited for the supply, delivery and erection at the First Extension of Belfast Municipal Electric Power Station West of Ormeau 4-TON MOBILE CRANE.

Forms of tender (N.1511), conditions, specifications and drawings, in quintuplicate, may be obtained from Messrs. Merz & McLellan, Consulting Engineers, Carliol House, Newcastle upon Tyne, 1, on payment of a deposit of five guineas, which will be refunded provided a bona fide tender is lodged and not withdrawn. Extra copies of the contract document may be obtained at one guinea each; this sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each tender, in quadruplicate, in sealed envelope marked "Tender for Mobile Crane, Electricity Department," and endorsed with the name and address of the tenderer, must be addressed to the Town Clerk, City Hall, Belfast, so as to reach him not later than 4 p.m. on Thursday, 29th July, 1954.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

EYRE GORDON,
Chairman,
Northern Ireland Joint
Electricity Committee.

Chichester House,
Chichester St., Belfast.
2nd July, 1954. 4017

BOROUGH OF ROMFORD

Engineer & Surveyor's Department

Firbank Road and Rush Green Road, Flat Sites

Electrical Installation

TENDERS are invited for electrical installation to 46 flats at the above sites. The specification and form of tender may be obtained from the Borough Engineer and Surveyor, Town Hall, Romford, on payment of a £2 2s. deposit (cheque) which will be refunded on receipt of a bona fide tender and all documents. Sealed tenders in envelopes provided must be delivered to the undersigned not later than Wednesday, 14th July, 1954.

J. TWINN,
Town Clerk.

Town Hall,
Romford.
June, 1954. 3957

HATFIELD RURAL DISTRICT COUNCIL

Sodium Street Lighting

TENDERS are invited for the supply and erection of 143, 60-watt sodium lamps on concrete columns, on the St. Albans and Great North Roads.

Plan, specification and particulars may be obtained from the Engineer & Surveyor, North Place, 82, Great North Road, Hatfield, Herts.

Tenders to be returned in a sealed envelope endorsed "Street Lighting," to reach the undersigned not later than first post on Wednesday, 21st July, 1954.

The Council does not bind itself to accept the lowest or any tender.

E. F. CULL,
Clerk of the Council.

Council Offices,
16, St. Albans Road,
Hatfield, Herts. 3956

THE ELECTRICITY TRUST OF SOUTH AUSTRALIA

Port Lincoln Power Station

Water Softening Units and Central Evaporating Plant

TENDERS are invited for the manufacture, delivery, supervision of erection, testing and setting to work of two 6,500-lb./hr. sodium base-exchange softening units and one 5,500-lb./hr. central evaporating plant of the thermo-compressor type having terminal steam conditions of 400 p.s.i. 750° F.

Specifications are available at the offices of the Design Engineer, Hindmarsh Buildings, Grenfell Street, Adelaide, and Messrs. Preece, Cardew & Rider, Consulting Engineers, 8, 10 and 12, Queen Anne's Gate, Westminster, London, S.W.1.

Tenders close on 20th August at 9.30 a.m. (B.S.T.) in London and 5 p.m. in Adelaide. No tender will necessarily be accepted. Tenders must be submitted in triplicate. Two copies to be lodged with the Chairman, Purchasing and Contracts Committee, Electricity Trust of South Australia, Kelvin Building, North Terrace, Adelaide, South Australia, and one copy to be lodged with Messrs. Preece, Cardew & Rider, Consulting Engineers, 8, 10 and 12, Queen Anne's Gate, Westminster, London, S.W.1, by the closing dates specified. 3975

BOROUGH OF KIDDERMINSTER

Electrical Installations, Retail Market

THE Council invite tenders for the supply, delivery and erection of the complete lighting and power installations, including fluorescent and tungsten lighting fittings, in the Retail Market, High Street, Kidderminster.

Specification, drawings, bills of quantities and form of tender may be obtained upon application not later than 16th July, 1954, from Messrs. Winton Thorpe, Tunnadine & Partners, Consulting Engineers, 100, Victoria Street, London, S.W.1, accompanied by a deposit of two guineas (returnable upon receipt of a bona fide tender).

Tenders are to be returned in sealed envelopes, endorsed "Tender, Retail Market," and addressed to the undersigned not later than 12 noon on Monday, 9th August, 1954. The Council do not bind themselves to accept the lowest or any tender.

J. L. EVANS,
Town Clerk.

Town Hall,
Kidderminster. 3947

METROPOLITAN BOROUGH OF WANDSWORTH

Sodium Lamps and Jackets

TENDERS are invited for the supply of 140-watt Sodium Lamps and Jackets.

Tender forms, etc., obtainable from the Borough Engineer at the undermentioned address, must be returned to me by noon, Wednesday, 21st July, 1954.

R. H. JERMAN,
Town Clerk.

Municipal Buildings,
Wandsworth, London, S.W.18.
29th June, 1954. 3992

METROPOLITAN BOROUGH OF WANDSWORTH

Street Lighting

TENDERS are invited for the supply and erection of concrete lamp columns and all ancillary gear for Group A Standard Street Lighting.

Tender documents, obtainable from the Borough Engineer, must be returned to me by noon, 21st July, 1954.

R. H. JERMAN,
Town Clerk.

Municipal Buildings,
Wandsworth, London, S.W.18. 3991

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the Local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order, 1952.

RESEARCH AND DEVELOPMENT

THE J. STONE GROUP OF COMPANIES which has extensive and expanding interests in electrical and mechanical engineering offers PERMANENT POSITIONS on its RESEARCH AND DEVELOPMENT STAFF to:—

(a) DESIGN AND LABORATORY ASSISTANTS for development of light electrical and mechanical equipment, with prospects of advancement later to technical or sales staff overseas. Previous design experience not essential, but applicants should be of degree standard, and have had works experience.

(b) SENIOR DRAUGHTSMEN dealing with light mechanical and electrical equipment, especially dynamo-electrical machinery, automatic control gear, and mechanical drives. Works experience essential. O.N.C. or H.N.C. preferred.

Applications in first instance to PERSONNEL MANAGER, J. STONE AND CO. (DEPTFORD) LTD., ARKLOW ROAD, LONDON, S.E.14, giving full details training, etc.

4012

ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS

Assistant Secretary (Education and Technical)

APPLICATIONS are invited for the above position on headquarters staff of the Association. Salary from £800 per annum, according to qualifications and experience. Experience in electrical engineering and ability to organise educational activities essential; experience in editorial and committee work an advantage.

Written applications should be sent to the General Secretary, 23, Bloomsbury Square, London, W.C.1, not later than Saturday, 24th July, in envelopes endorsed "Assistant Secretary." 3980

THE MULLARD RADIO VALVE CO. LTD.

has senior and junior staff vacancies in several of its Development Departments situated in or near Mitcham, Surrey. The field in which applicants would be required to work are listed below:—

Ref. W.1.
RECEIVING VALVE DEVELOPMENT DEPARTMENT.
(a) The general engineering development of receiving valves.

(b) Glass techniques, including the control of existing and experimental work on new methods.

(c) The investigation of manufacturing processes with a view to attaining closer control and further development.

Ref. W.2.
GAS FILLED VALVE DEVELOPMENT DEPARTMENT.
(a) The technological development of hot cathode gas filled rectifiers and thyratrons of all sizes and classes.

(b) The general development of cold cathode gas filled valves including stabilisers and reference tubes and also multi-electrode types.

(c) Investigational work on gas discharge phenomena in relation to the tube classes mentioned under (a) and (b) above.

Ref. W.3.
U.H.F. AND TRANSMITTING VALVE DEVELOPMENT DEPARTMENT.
(a) The technological development of magnetrons, klystrons, travelling wave tubes and kindred devices. This work includes metal-glass sealing, ceramic and metal brazing techniques.

(b) General development work on the more conventional glass, metal-glass and disc seal valves usually for the V.H.F. range.

(c) Investigational work on the effects of variation of mechanical structure and of changes in materials used for (a) and (b) above.

Ref. W.4.
CATHODE RAY TUBE DEPARTMENT
(a) The glass, mechanical and chemical technology of all types of cathode ray and kindred tubes including colour television tubes.

(b) Process development of methods used for the manufacture of new types of cathode ray tubes.

(c) Improvements in gun design including electron optical work.

Ref. W.5.
SEMI-CONDUCTOR DEVELOPMENT DEPARTMENT.
(a) The technological development of all types of semi-conducting devices including transistors and rectifiers.

(b) The investigation of semi-conducting materials to establish their possible application to practical devices.

(c) The development of processes and production methods for semi-conducting devices.

Applicants for the senior posts should be physicists, electrical engineers or, where appropriate, physical chemists and should possess a university degree or equivalent qualifications.

For the more junior posts candidates should possess Advanced Level G.C.E. in science subjects or equivalent qualifications, or should be pursuing courses leading to H.N.C. or external degrees.

For both grades past experience in similar work is desirable but not essential.

The vacancies outlined above are caused by the expansion of the Company's activities in these fields. Salaries will be according to individual age and experience and qualifications and can be considered as progressive. Company policy regarding the employment of scientific staff provides adequate prospects for advancement and breadth of outlook is assured by opportunities of transfer to other fields of work within the Company's activities. There are facilities for further study and a Company Pension Scheme.

Applications in writing, which will be treated with the strictest confidence, should be addressed to the Personnel Officer, The Mullard Radio Valve Co. Ltd., New Road, Mitcham Junction, Surrey, quoting the appropriate reference number. 3997

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or C. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

JUNIOR ENGINEERS (Control), Bankside Generating Station (Vacancy No. 54/526). Duties include assisting in main control room, with opportunity for gaining general knowledge of power station. Shift duties. Salary Class H, Grade 15/3 = £473 p.a.

JUNIOR ENGINEER, Hackney Generating Station (Vacancy No. 54/527). Good technical training with generating station experience desirable. General duties in station operation. Salary Class F, Grade 14/3 = £491 p.a.

STATION SHIFT CONTROL ENGINEER, St. Marylebone Generating Station (Vacancy No. 54/528). Practical experience in control room operation necessary. Salary Class E, Grade 10 = £582 15s. p.a.

GENERAL ASSISTANT ENGINEER (Assistant Section Engineer), Transmission Department (Vacancy No. 54/529). Candidates should have a wide experience in operation and maintenance of high voltage transmission equipment. Salary N.J.B. Schedule C, within range Class AX, Grade 6, £613 4s./£756, rising to ultimate maximum Class EX, Grade 6, £849 9s. p.a.

Applications, quoting vacancy number, may be made on form from Divisional Secretary, British Electricity Authority, London, Division, Generation House, Great Portland Street, W.1, and be received within 14 days of this advertisement. 4015

BRITISH ELECTRICITY AUTHORITY

Midlands Division

SENIOR ASSISTANT ENGINEER (Mechanical) is required in the Chief Generation Engineer's (Construction) Department at Divisional Headquarters. N.J.B. service conditions, superannuable appointment, salary within Schedule C, Grade 1, commencing in range £970 to £1,103, ultimately rising to £1,198 per annum.

Duties will consist of the preparation of designs and layout of mechanical equipment for power stations, particularly with regard to turbo-alternators and condensing plant, feed heating equipment, boilers, high pressure steam and feed piping, coal and ash handling plants, and ancillary equipment. The work also involves the preparation of specifications, the examination of and reporting on tenders, the supervision of contracts and approval of contractors' designs, site erection and commissioning. Applicants should preferably possess a university degree in mechanical or electrical engineering or be Corporate Members of the Institution of Mechanical and/or Electrical Engineers.

Apply, quoting vacancy number 702MD on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 24th July, 1954. 4032

THE ELECTRICITY BOARD, BELIZE, BRITISH HONDURAS

Electrical Engineer

APPLICATIONS are invited for the appointment of an ELECTRICAL ENGINEER in the service of the Electricity Board, Belize, British Honduras.

The present supply system which is 110/220 volt, 3-wire D.C. is to be changed over to 6,600 volts and 220 volts, 3 phase, 60 cycles A.C., three new 800-kW diesel-alternator sets are to be installed and two existing 400-kW diesel sets converted from D.C. to A.C.

The engineer will be required, initially, to supervise the changeover of the distribution system from D.C. to A.C. and the erection of the generating sets and ultimately to take charge of the operation and maintenance of the distribution system and the generating plant.

Candidates should be Corporate Members of the Institution of Electrical Engineers or hold qualifications exempting them from the Institution examination and must have had considerable experience in the construction and operation of L.V. overhead distribution networks and H.T. overhead lines up to 6,600 volts. They must also have had some experience in the erection and operation of diesel engines up to 1,000 h.p.

The appointment will be on a salary scale of £900 per annum rising by annual increments of £150 to a maximum of £1,200 per annum. The point of entry into the salary scale will depend on the candidates age, qualifications and experience. Details of provident fund, 6%.

A car allowance of £5 per month will be paid.

The appointment will be for a period of 3 years in the first instance terminable by three months' notice on either side and may be renewable by mutual consent.

Free passages will be provided for the officer and his family up to four full passages, on first appointment, on termination of the agreement and for long leave in the United Kingdom.

Leave is earned at the rate of sixty days per year of residence in service and may be accumulated. (Earned leave to the United Kingdom may be taken after three years' service.)

Applications endorsed "Electrical Engineer, Belize," stating age, qualifications and experience, should be forwarded within 21 days of the date of this advertisement to the undersigned who will communicate with candidates selected for further consideration.

PREECE, CARDEW & RIDER,
8-12, Queen Anne's Gate,
Westminster, London, S.W.1. 3959

HER MAJESTY'S COLONIAL SERVICE

Vacancies for Signals Officers, Aviation Department, Nigeria

DUTIES are to maintain all aeronautical mobile telecommunications and radio navigational aid equipment at Civil Aerodromes in Nigeria and to ensure that I.C.A.O. procedures and practices are observed.

Appointment is either pensionable on probation in the salary scale £910-£1,560 or on contract in the scale £1,116-£1,898; point of entry depending on war services and approved experience. A gratuity of £100-£150 per annum is payable on satisfactory completion of contract appointment.

Free first-class passages are provided for the officer and his wife, and an allowance of £75 per annum each is payable in respect of a maximum of two children. Leave is granted at rate of 7 days for each month of resident service. Government quarters, if available, are provided at low rental.

Candidates must be A.M.I.E.E., or have taken or be exempted from sections A and B of the examination for Associate Membership provided they attain Corporate Membership within 3 years, or have a 1st or 2nd class Honours degree in Engineering or Physics. Previous experience with aeroautical telecommunications equipment is desirable. A knowledge of modern theory and practice or radio and electricity and its application to air navigation, with particular reference to the procedures and other requirements of the International Civil Aviation Organisation is necessary.

Apply in writing to the Director of Recruitment, Colonial Office, Great Smith Street, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number BCD. 98/14/01. 3960

YORKSHIRE ELECTRICITY BOARD

No. 5 (Wakefield) Sub-Area

DONCASTER DISTRICT

DISTRICT ENGINEER. Applicants should be Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications. They must be widely experienced in all branches of electricity distribution work covering industrial, urban and rural areas with underground and overhead systems.

Salary N.J.B. Class F, Grade 3, £912/£951 per annum.

SENIOR SALES REPRESENTATIVE. Applicants must have had practical experience in negotiating with and advising urban and rural consumers in respect of new and increased supplies, in the sale and use of domestic, agricultural and industrial equipment, and on tariffs. They should preferably have had experience in the compilation and maintenance of consumers' records and the preparation of reports and statistics.

Applicants must hold a current driving licence.

Salary N.J.C. Grade 2, £485/£545 per annum.

BARNSLEY DISTRICT

ASSISTANT CONSUMERS' ENGINEER. Applicants, who must have had a sound practical training and a fair amount of experience in the work of a consumers' engineer, will be required to give advice to all classes of consumer concerning the utilisation of electricity. Experience in the interpretation of the I.E.E. wiring regulations and in tariffs will be of advantage. Preference will be given to applicants holding a Higher or Ordinary National Certificate in Electrical Engineering or some other approved qualification.

Salary N.J.B. Class F, Grade 10, £577/£598 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Road, Wakefield, not later than 21st July, 1954.

No. 3 (Sheffield) Sub-Area

SENIOR DRAUGHTSMAN. Applicants should have had a sound technical education and be first-class draughtsmen with drawing office experience within the electricity supply industry.

A knowledge of the design, construction and survey of overhead and underground distribution systems up to 33 kV is necessary.

The successful candidate will be responsible to the Chief Draughtsman for the preparation of plans for mains records and extensions, statutory notices and wayleaves, and for the training of junior draughtsmen in this work.

Salary N.J.B. Schedule D, Grade 5, £567/£671 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 21st July, 1954.

No. 6 (Hull) Sub-Area

HULL DISTRICT

GENERAL ASSISTANT DISTRICT ENGINEER (HULL). Applicants should have had a good general and technical education with practical training, preferably in the electricity supply industry, and should be Graduate Members of the Institution of Electrical Engineers, or hold equivalent qualifications. They should have experience in the construction of overhead lines, and experience in operation and maintenance will be an advantage.

The successful applicant will be required to reside in Hull and may be required to undertake standby duties.

Salary N.J.B. Class J, Grade 11, £639/£665 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 21st July, 1954.

No. 7 (Grimsby) Sub-Area

SCUNTHORPE AND GAINSBOROUGH DISTRICTS

Electricians required for general installation work.

N.J.I.C. rate of pay and conditions of service, the present rate being 3s. 9d. per hour for a 44-hour, 5-day week.

Applications, giving full details of age, training and experience, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than 21st July, 1954. 3996

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF GENERAL ASSISTANT ENGINEER (INSTALLATION CONTRACTS), SUB-AREA CONSUMERS' ENGINEER'S DEPARTMENT, BOLTON

APPLICANTS should have experience in the preparation of schemes and estimates and the supervision of all types of installation work in industrial and commercial premises and public buildings.

Salary scale £616/£646 p.a. Grade L.13. N.J.B. conditions.

Applications to the sub-Area Manager, No. 2 Sub-Area, North Western Electricity Board, National Buildings, St. Mary's Parsonage, Manchester, 3, by 17th July, 1954.

APPOINTMENT OF SECOND ASSISTANT DISTRICT ENGINEER, PRESTON DISTRICT

Duties will include the operation, maintenance and construction of underground and overhead mains, substations and transformers, and general mains work including standby duty. Applicants should state their experience in high voltage work. Possession of a National Certificate in Electrical Engineering will be an advantage.

Salary scale £697/£718 p.a. Grade F.7. N.J.B. conditions.

Applications to the Manager, No. 4 Sub-Area, North Western Electricity Board, 40/41, Lune Street, Preston, by 17th July, 1954.

APPOINTMENT OF THIRD ASSISTANT DISTRICT ENGINEER, WHITEHAVEN DISTRICT

Applicants should be capable of preparing schemes and estimates for medium voltage extensions and of supervising construction. Possession of the H.N.C. in Electrical Engineering would be an advantage.

Salary scale £607/£629 p.a. Grade F.9. N.J.B. conditions.

APPOINTMENT OF SECOND ASSISTANT ENGINEER (PLANNING AND CONSTRUCTION), SUB-AREA MAINS ENGINEER'S DEPARTMENT, KENDAL

Applicants should have wide experience in the design, survey, and construction of overhead and underground transmission and distribution systems with associated substations, operating at pressures up to 33 kV, including rural electrification. Candidates should preferably be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

Salary scale £817/£852 p.a. Grade J.7. N.J.B. conditions.

Applications for the above posts to Sub-Area Manager, No. 6 Sub-Area, North Western Electricity Board, Castle Green, Kendal, by 17th July, 1954. 3995

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

STATION SHIFT CONTROL ENGINEER, Croydon "A" Power Station.

Applicants, who should preferably possess H.N.C. in Electrical Engineering, must have had experience in the operation and control of turbo-generators and in control room duties connected with inter-connected generating systems and E.H.T. feeder network. Class F, Grade 10, £605 17s. including London allowance.

JUNIOR ENGINEER (Instruments), Brighton "B" Power Station.

Applicants should preferably possess O.N.C. and should have had experience in the maintenance, testing and calibration of all types of power station instruments. A knowledge of electronics would be an advantage. Class J, Grades 8/14, commencing at £402 per annum. N.J.B. conditions of service and salary for both positions.

Applications, giving details of education, experience, present position, etc., should be received by the Station Superintendent at either Croydon "B" Power Station, Beddington Farm Road, Croydon, Surrey, or Brighton Power Station, Portslade-by-Sea, according to the location of the vacancy, by 17th July. 4014

BRITISH ELECTRICITY AUTHORITY

North Eastern Division

Stella North and South Power Stations

APPLICATIONS are invited for the following appointments which will be made during the present year:—

1. STELLA SOUTH POWER STATION, BLAYDON ON TYNE
(a) DEPUTY STATION SUPERINTENDENT. Grade 3, Class K (£1,182-£1,233).
(b) OPERATION & EFFICIENCY ENGINEER Grade 5, Class K (£1,003-£1,047).
(c) MAINTENANCE ENGINEER (Mech.). Grade 6, Class K (£936-£977).
(d) 5 SHIFT CHARGE ENGINEERS. Grade 7, Class K (£869-£907).
(e) STATION CHEMIST. Grade 7, Class K (£869-£907).

2. STELLA NORTH POWER STATION, NEWBURN ON TYNE
(a) DEPUTY STATION SUPERINTENDENT. Grade 3, Class J (£1,104-£1,156).
(b) OPERATION & EFFICIENCY ENGINEER Grade 5, Class J (£942-£983).
(c) MAINTENANCE ENGINEER (Mech.). Grade 6, Class J (£883-£918).
(d) 5 SHIFT CHARGE ENGINEERS. Grade 7, Class J (£817-£852).
(e) STATION CHEMIST. Grade 7, Class J (£817-£852).

Applicants for appointments (a) and (b) should have had wide experience in the operation, maintenance and administration of power stations, and those for (c) and (d) previous experience in a large power station.

Applicants for appointment (e) should possess an A.R.I.C. or equivalent qualification.

Forms of application may be obtained from Divisional Establishments Officer, British Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne, 1, to whom they should be returned to arrive not later than 21st July, 1954. 4027

WARWICKSHIRE EDUCATION COMMITTEE

Rugby College of Technology and Arts

Principal: W. Cooper, M.A., B.Sc.

APPLICATIONS are invited for the following posts in the Department of Electrical Engineering, vacant on 1st September, 1954.

(A) LECTURER IN ELECTRICAL ENGINEERING to teach Electrotechnology up to Higher National Certificate and Degree standard, and to specialise in Electronics.

Applicants should hold a degree in physics or electrical engineering and should have industrial and teaching or research experience.

(B) ASSISTANT GRADE B to teach Mathematics up to Higher National Certificate standard to engineering students.

Applicants should hold an appropriate degree or graduate qualifications of the Institution of Electrical Engineers and have had some teaching and industrial experience.

Salary in accordance with the Burnham technical scales as follows: Lecturer, £940 × £25 to £1,040; Grade B, £490 × £25 to £765.

Application forms and further particulars may be obtained by sending a stamped addressed foolscap envelope to the undersigned by whom applications should be received as soon as possible.

W. COOPER,
Principal.

College of Technology and Arts,
Eastlands,
Rugby.
June, 1954. 3979

CONTACTOR SWITCHGEAR LTD.

ENGINEERS required for both Engineering and Estimating Departments for control gear applications up to 1,000 h.p., low and high tension.

The company operates a contributory pension scheme and will share cost of removal in approved cases.

Applicants should have completed their National Service and preferably be not over 45.

Write in confidence to the Secretary, Moorfield Road, off Upper Villiers Street, Wolverhampton. 3855

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the following positions within the Division:—

TWO ENGINEERING DRAUGHTSMEN (CIVIL), CONSTRUCTION DEPARTMENT (Vacancy No. 1/54/ER). Candidates should have experience in the preparation of detail drawings and in the design of one or more of the following subjects:—

Reinforced concrete structures.
Piled and slab foundations for heavy components.
Cable subways, bridges and culverts.

The salary will be in accordance with Grade 4 (£671-£780 per annum) or Grade 5 (£567-£671 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 22nd July, 1954.

TWO ENGINEERING DRAUGHTSMEN (MECHANICAL), CONSTRUCTION DEPT. (Vacancy No. 2/54/ER). Candidates should have experience in one or more of the following:—

(i) Design and layout of power station equipment, including turbo-alternators, boiler plant, coal and ash plant and general station auxiliaries.
(ii) H.P. and L.P. steam and feed pipework; condensing plant and feed heating systems.
(iii) Conveyor plant, coal handling systems and material handling of station auxiliary equipment.

The salary will be in accordance with the National Joint Board Agreement, Grade 4 (£671-£780 per annum) and Grade 5 (£567-£671 per annum) of Schedule D, according to experience.

Closing date for receipt of applications, 22nd July, 1954.

FOUR ENGINEERING DRAUGHTSMEN (ELECTRICAL), CONSTRUCTION DEPARTMENT (Vacancy No. 3/54/ER). Candidates should have experience in the preparation of layouts and diagrams for the installation of E.H.T. and L.T. switchgear, transformers, E.H.T. and L.T. cables; knowledge of protective gear systems would be an advantage.

The salary will be in accordance with the National Joint Board Agreement, Grade 4 (£671-£780 per annum) and Grade 5 (£567-£671 per annum) of Schedule D, according to experience.

Closing date for receipt of applications, 22nd July, 1954.

OPERATION AND EFFICIENCY ENGINEER, Drakelow Power Station, Nr. Burton-on-Trent (Vacancy No. 95/54/ER). Candidates should have wide experience of the operation and maintenance of a large generating station with P.F. boiler plant. The successful applicant will be responsible to the Station Superintendent for ensuring that all sections of the plant attain the specified efficiency and for the carrying out of special investigations and tests.

Corporate Membership of the Institution of Mechanical Engineers and/or Institution of Electrical Engineers is desirable.

Salary for this appointment will be within Class J, Grade 6 (£883-£918 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 19th July, 1954.

ASSISTANT SHIFT CHARGE ENGINEER, Spondon Power Station (Vacancy No. 96/54/ER). Applicants should possess the Higher National Certificate or its equivalent and have had experience in a responsible position in a modern generating station.

The salary will be in accordance with Class H, Grade 9 (£680-£706 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 19th July, 1954.

These appointments will be pensionable within the terms and conditions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller. 4030

AIR MINISTRY

MECHANICAL AND ELECTRICAL ENGINEERS required in Works Department for design, operation and maintenance of mechanical and electrical services on R.A.F. stations at home and overseas and Civil Aviation stations. Appointments in two grades (a) Main Grade, salary scale £1,000 to £1,320 and (b) Assistant Grade £650 to £1,000. Starting pay according to qualifications and experience. Salaries somewhat lower in provinces. Candidates should be age 25 or over. Appointments temporary and non-pensionable but with long term possibilities. Special allowance up to £1,500 a year according to location payable in addition to salary during overseas service. Candidates must be natural born British subjects of natural born British parents.

Minimum qualifications and experience for both grades of posts:—

(i) (a) University degree or equivalent diploma in electrical and/or mechanical engineering and at least a two-year apprenticeship or (b) Graduate or Corporate Membership of the Institutions of Mechanical or Electrical Engineers with appreciable electrical engineering experience and at least three years apprenticeship and (ii) employment in responsible position for minimum of three years with well-established engineering concern providing wide experience in electrical and mechanical engineering practice.

Application forms, quoting reference D1/54A, from M.L. & N.S., Technical and Scientific Register (K), Almack House, King Street, London, S.W.1. 3958

COUNTY BOROUGH OF BRIGHTON EDUCATION COMMITTEE

Brighton Technical College

Principal: G. E. Watts, M.A., Ph.D. (Cantab.), B.Sc.(Lond.), F.R.I.C.

REQUIRED as soon as possible:
ASSISTANT LECTURER (Grade B) in Electrical Engineering with degree or equivalent qualification in electrical engineering and appropriate teaching and/or industrial experience, to teach principles of electricity and electrical technology to at least H.N.D. standard. Ability to offer one specialist subject in electronic or power engineering would be an advantage.

Salary at present £490 × £25 to £765 plus graduate allowance £60 and increments for approved training and/or industrial experience.

Further particulars and application forms may be obtained from the undersigned. Completed forms should be returned to the Principal, Brighton Technical College, Brighton, 7, within fourteen days.

W. G. STONE,
Director of Education,
Education Office,
54, Old Steine,
Brighton, 1. 3948

COUNTY COUNCIL OF ESSEX

Architect's Department

ASSISTANT ELECTRICAL ENGINEER, Grade V, on established staff. Salary not exceeding £670 p.a. Commencing salary according to qualifications and experience.

Candidates must be capable of designing electrical installations for schools, colleges and other public buildings.

Application forms from H. Conolly, F.R.I.B.A., County Architect, County Hall, Chelmsford, Essex, returnable with copies of three recent testimonials by 26th July, 1954.

Canvassing disqualifies. 4036

CABLE INSTALLATION ENGINEERS FOR AUSTRALIA

ASSISTANT ENGINEERS required for cable installation work for permanent service in Australia with large Cable Manufacturing and Contracting Company.

Salary according to qualifications and experience.

Applicants will receive a period of training in the United Kingdom before appointment confirmed.

Apply, stating age, qualifications and experience to, Box 3912.

APPOINTMENT OF PRINCIPAL

A PROMINENT and progressive industrial organisation in the North-West is establishing a special school for the tuition and development of electronic engineers and applications are invited for the post of PRINCIPAL.

Applicants must have a University degree and have had teaching experience. They must be up-to-date in modern electronic techniques, and the duties will comprise the tuition of students of varying ages and qualifications and the development of the necessary syllabuses to cover a full range of subjects in the electronic field, under the general guidance of a board of senior officials. Good personality, teaching ability and a progressive outlook are essential and a salary commensurte with the position and individual qualifications will be paid.

Applicants should write to—Box 904, Dorland Advertising Ltd., 18-20, Regent Street, London, S.W., giving full particulars of their qualifications, age, experience and approximate salary sought. 4055

DESIGN ENGINEER

AN EXCEPTIONAL OPPORTUNITY exists in SOUTH EAST LONDON for a DESIGN ENGINEER with sound theoretical knowledge and recent industrial experience in the design of A.C. and D.C. machines, and low voltage control gear.

This appointment offers rapid advancement to a position of superior technical and administrative responsibility. The salary will be commensurate with the requirements.

Applications, giving full details of training and experience, should be sent to—Box 2V, G7250, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2. 4013

BRITISH ELECTRICITY AUTHORITY

Southern Division (S/13.548)

APPLICATIONS are invited for the following position: ASSISTANT SHIFT CHARGE ENGINEER, SWINDON GENERATING STATION. Applicants must have had previous experience in a modern generating station. Manufacturing works experience will be an advantage. Preference will be given to those who possess qualifications and experience relating to corporate membership of a recognised professional institution or who are studying for the examinations of an institution.

Salary, N.J.B., Class E, Grade 9 (£587-£600).

Special application forms obtainable from P. D. A. Oliver, Divisional Secretary, High Street, Portsmouth, should be returned not later than 21st July, 1954. 4071

BERKSHIRE COUNTY COUNCIL

Electrical Engineer, Grade VIII (£735 - £810)

A FIRST class man with experience, energy and initiative is required in the County Architect's Department for the design of schemes for new and old buildings and general work in connection with electrical installations.

To qualify for the above salary, men must be Associate Members of the Institution of Electrical Engineers, otherwise the salary will be on Grade VI (£695-£760).

Application forms from the County Architect, Wilton House, Parkside Road, Reading, to be returned by 23rd July, 1954.

E. R. DAVIES,
Clerk of the Council. 3949

BRITISH ELECTRICITY AUTHORITY

North West, Merseyside and North Wales Division

VACANCY No. 112/54. STATION SHIFT CONTROL ENGINEER, Agecroft "A" Generating Station, Near Manchester. Salary £57 /£598 (F.10).

Vacancy No. 113/54. FIRST ASSISTANT STATION CHEMIST, Huncoat Generating Station Near Accrington. Salary £607/£629 (F.9).

Vacancy No. 115/54. ASSISTANT SHIFT CHARGE ENGINEERS (2), Huncoat Generating Station, Near Accrington. Salary £607/£62 (F.9).

Vacancy No. 116/54. ASSISTANT SHIFT CHARGE ENGINEER, Roosecote Generating Station, Near Barrow-in-Furness. Salary £641/£66 (G.9).

Vacancy No. 118/54. STATION SHIFT CONTROL ENGINEER, Radcliffe Generating Station Near Manchester. Salary £577/£598 (F.10).

Vacancy No. 119/54. SHIFT CHARGE ENGINEER, Greenhill Generating Station, Oldham. Salary £649/£681 (E.7).

Apply, quoting vacancy number, to Controller, British Electricity House, 825, Wilmslow Road, Manchester, 20, before 17th July. 3993

BRITISH ELECTRICITY AUTHORITY

Yorkshire Division

APPLICATIONS are invited for appointments as DEPUTY STATION SUPERINTENDENT at (a) Neepsend Power Station, Sheffield and (b) Huddersfield Power Station.

Salary (a) £1,035-£1,081 p.a., Class H, Grade 3, N.J.B. Agreement.
(b) £912-£951 p.a., Class F, Grade 3, N.J.B. Agreement.

Applicants for both appointments should have had good technical education and practical experience in the operation, maintenance and administration of a modern power station. Preference will be given to candidates who are Corporate Members of the Institution of Mechanical Engineers and/or Institution of Electrical Engineers.

Application forms obtainable from the Divisional Secretary (Establishments), British Electricity House, St. Mary's Road, Leeds, 7, to be returned within 14 days of the appearance of this advertisement.

G. A. VOWLES,
Divisional Controller. 4035

BRITISH ELECTRICITY AUTHORITY

Midlands Division

SENIOR ASSISTANT ENGINEER (Civil) is required in the Chief Generation Engineer's (Construction) Department at Divisional Headquarters. N.J.B. service conditions, superannuable appointment, salary within Schedule C, Grade 1, commencing in range £970 to £1,103, ultimately rising to £1,198 per annum.

Applicants should be experienced in the design and construction of heavy foundations, structural steel and ferro-concrete frames, and building works associated with modern power stations including office blocks, canteens, and similar structures. The work also involves the preparation of specifications, the examination of tenders, the supervision of contracts and approval of contractors' designs. Applicants should preferably be corporate members of the Institute of Civil Engineers or hold equivalent qualifications.

Apply, quoting Vacancy No. 703MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 24th July, 1954. 4031

ESSEX EDUCATION COMMITTEE

South East Essex Technical College Longbridge Road, Dagenham

REQUIRED, September (or as soon as possible after), ASSISTANT GRADE B for Electrical Engineering subjects. Salary (under review), £490 × £25-£765 (man), plus degree (or equivalent) and training additions, and increments for previous recognised experience.

Further details and form from Clerk to Governors (S.A.E.). 4069

ADMIRALTY—ROYAL NAVAL SCIENTIFIC SERVICE

SENIOR SCIENTIFIC OFFICERS and SCIENTIFIC OFFICERS required in Experimental Establishments in London, Portsmouth, Weymouth and Gloucestershire areas and Scotland. The majority of posts are for Engineers and Physicists (particularly with Electronics).

Candidates must be British subjects with an appropriate first or second class honours degree or equivalent high professional attainments.

Salaries: S.S.O. (M) £975-£1,150; S.O. (M) £470-£855. London rates. Somewhat lower in Provinces. All appointments are unestablished (with F.S.S.U.), but with some opportunities to compete for established posts.

Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting A.246/52/A. 3723

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following post:—

SHIFT CHARGE ENGINEER, Rye House Generating Station. Salary Class G, Grade 7, £729-£758 per annum.

Applicants should preferably have served an apprenticeship and obtained a recognised qualification in electrical or mechanical engineering and possess experience in the operation of a generating station fired with pulverised fuel.

Applications, giving age and details of qualifications and experience, should be submitted to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, London, N.14, to arrive not later than 17th July, 1954.

W. N. CLINCH,
Controller. 3994

BRITISH ELECTRICITY AUTHORITY

Midlands Division

GENERAL ASSISTANT ENGINEER is required in the System Operation Department at Divisional Headquarters, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule C, Grade 8, commencing in range £501 to £639, ultimately rising to £714 per annum.

Duties are of a general statistical and technical nature, associated with the group operation of power stations, and the successful applicant will be required to carry out shift duties as necessary in the system control room. Power station experience and appropriate technical qualifications will be considered advantages.

Apply, quoting vacancy number 704MD on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 24th July, 1954. 4033

SENIOR CABLE ENGINEER

A VACANCY has occurred for a SENIOR CABLE ENGINEER in the Research Department of an old-established London cable maker.

The position involves responsibility to the Research Manager for the design, manufacturing technique, testing and installation of all types of solid and gas pressure cables and accessories, and carries a good salary with generous benevolent and pension schemes.

Full details of training and qualifications with particular reference to experience in high voltage cable practice should be given.—Box 3961.

NORTH EASTERN ELECTRICITY BOARD

Wear Sub-Area

APPLICATIONS are invited for the appointment of THIRD ASSISTANT DISTRICT ENGINEER, Durham District. Salary, Schedule A, Class F, Grade 9, £607/£629 per annum. N.J.B. conditions of service.

Applications, stating age, qualifications and experience, should be forwarded to the Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, 1, within seven days of the appearance of this advertisement. 4029

BRITISH ELECTRICITY AUTHORITY

Southern Division (S/13.547)

APPLICATIONS are invited for the following position:—

ASSISTANT SHIFT CHARGE ENGINEER, Poole Generating Station. Applicants should have had previous experience in a large modern generating station, and preference will be given to those with experience of high operating temperatures and pressures, and pulverised fuel equipment. Manufacturing works experience will be an advantage.

Preference will be given to those who possess qualifications leading to Corporate Membership of a recognised professional institution.

Salary N.J.B. H/9, £680-£706.

Special application forms, obtainable from P. D. A. Oliver, Esq., Divisional Secretary, 111, High Street, Portsmouth, should be returned by 21st July, 1954. 4034

SOUTH WEST SCOTLAND ELECTRICITY BOARD

Clyde Sub-Area

THIRD ASSISTANT DISTRICT ENGINEERS required for the Clydebank District. Salary scale Class G, Grade 9, £641/£667 per annum. Corporate Membership of the Institution of Electrical Engineers or the possession of the Higher National Certificate or an equivalent qualification would be an advantage. Applicants should have some experience of both H.V. and L.V. underground and overhead distribution systems, including switchgear.

Applications should be forwarded to the Manager, South West Scotland Electricity Board, Clyde Sub-Area, 206, St. Vincent Street, Glasgow, C.2, within 10 days of the appearance of this notice. 4020

THE BELMOS COMPANY LIMITED

Bellshill, Lanarkshire

Research Engineers

APPLICATIONS are invited for appointments to the staff of a research unit for work on problems associated with control gear, contactors and low-voltage switchgear. Candidates should have a good honours degree, and have completed a period of postgraduate industrial training. Preference will be given to those who have had some experience in an appropriate field of engineering or in experimental research.

Salaries will be commensurate with qualifications and experience, which should be stated in letters of application addressed to the Managing Director. 3856

MIDDLESEX COUNTY COUNCIL

County Architect's Department

ELECTRICAL ENGINEERING ASSISTANT required. Salary A.P.T. IV (£580 to £625 p.a. plus London weighting). Appointment at grade minimum, established and pensionable subject to medical assessment and prescribed conditions. Should have served apprenticeship or had practical experience in wiring installation work and have been employed on design of electrical services for schools or other large buildings. Required to work with minimum supervision.

Application forms (stamped addressed foolscap envelope) from County Architect, 1, Queen Anne's Gate Buildings, Dartmouth St., London, S.W.1, returnable by 19th July (quote N.745ER). Canvassing disqualifies. 4039

UNIVERSITY COLLEGE, CORK

College Lectureship in Electrical Engineering
College Lectureship in Mechanical Engineering

THE Governing Body of University College, Cork, invites applications for the above College Lectureships. Applications must be received by the Secretary on or before 12 noon on 16th August, 1954.

For further particulars apply to
JAMES HURLEY,
Secretary. 4038

NORTH EASTERN ELECTRICITY BOARD

Wear Sub-Area

APPLICATIONS are invited for the appointment of FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER, Hesledon District. Applicants should be suitably qualified electrical engineers with experience in all aspects of service to domestic, commercial and smaller industrial consumers. Salary Schedule A, Class E, Grade 6, £699/£725 per annum. N.J.B. conditions of service.

Applications, stating age, qualifications and experience, should be forwarded to the Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, 1, within seven days of the appearance of this advertisement. 4028

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS invited for positions of COMMERCIAL ASSISTANT in the following districts of the Western Sub-Area:—

District 104, Lampeter.
District 105, Llandilo.

Applicants must have had experience in the application of electricity to domestic and commercial premises and all general purposes.

Salary Class C, Grade 10 (£502/£512/£521) of N.J.B. Schedule.

Applications, stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 17th July, 1954.

D. G. DODDS,
Secretary.

St. Mellons,
Cardiff. 4022

SOUTH WALES ELECTRICITY BOARD

FIRST ASSISTANT DISTRICT ENGINEER required in District 347 (Cardiff East) in the Central Sub-Area.

Applicants should have experience in the construction, operation and maintenance of substations and underground and overhead high and low voltage mains in the urban and rural areas.

Salary Class G, Grade 4 (£905/£925/£944) of N.J.B. Schedule.

Applications, stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 17th July, 1954.

D. G. DODDS,
Secretary.

St. Mellons,
Cardiff. 4021

UNIVERSITY OF BIRMINGHAM

Electrical Engineering Department

APPLICATIONS are invited for a GRADE II LECTURESHIP for the Session 1954-1955 (salary £550-£1,100 according to qualifications and experience). There would be some preference for a candidate with experience of teaching of the theory of alternating currents and electrical machines.

Applications (3 copies), with the names of three referees, should reach the Registrar, The University, Birmingham, 15, not later than 24th July, 1954.

C. G. BURTON,
Secretary.

The University,
Birmingham, 15. 4040

SOUTH WALES ELECTRICITY BOARD

SENIOR FEMALE DEMONSTRATOR required, District 223 (Swansea) in the West Central Sub-Area.

Duties will include the demonstration of cookery and electrical appliances in showrooms, residences, and at demonstrations, showroom duties and supervision of other demonstrators.

Salary Grade 2 (£485/£545) of N.J.C. Schedule.

Applications, stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 17th July, 1954.

D. G. DODDS,
Secretary.

St. Mellons,
Cardiff. 4024

POWER STATION SUPERINTENDENT

required by the GAMBIA GOVERNMENT for two tours of 18 months each in the first instance.

Salary scale (including expatriation pay) £798 rising to £1,263 a year. Gratuity at the rate of £100 a year. Liberal leave on full salary. Outfit allowance £60. Free passages for officer and wife. Assistance towards cost of children's passages or grant up to £72 annually for maintenance in U.K.

Candidates should have served an apprenticeship with turbo pressure charged diesels and must have subsequent electrical and mechanical experience in diesel power stations including parallel operation of sets. An H.N.C. would be an advantage.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30633/EF. 3976

SOUTHERN ELECTRICITY BOARD

Installation Assistant

BASINGSTOKE District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class D, Grade 11, Column 1 (£500 per annum). N.J.B. conditions of service.

Applicants should have had experience in the preparation of specifications and estimates for all types of electrical wiring installations and should be competent to supervise electricians and organise allocation of work.

The successful candidate will be required to contribute to the B.E.A. and Area Boards Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him not later than 23rd July, 1954. 4019

BRITISH ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 68/54

APPLICATIONS invited for superannuable N.J.B. appointment of SHIFT CHARGE ENGINEER at Llanelly Power Station. Salary, E.7, £649-£681 per annum.

Applicants should preferably have obtained H.N.C. and served a regular apprenticeship. Operating experience in a power station essential.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 24th July, 1954.

2nd July, 1954. 4070

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT ENGINEER, Sutton District. Salary, £466 p.a., under N.J.B., Class F, Grade 13, plus London allowance. Superannuable. Applicants should have had a good general education and technical training up to Higher National Certificate standard or equivalent. Experience in distribution work and E.H.V. and L.V. supply is essential.

Applications on forms from C. W. Emanuel, M.I.E.E., Sutton Manager, SEEBoard, 52, High St., Sutton, Surrey, to be returned naming 2 referees by 21st July, 1954.

A. L. BURNELL,
Secretary.

4026

HERTFORDSHIRE COUNTY COUNCIL

County Architect's Department

ASSISTANT ELECTRICAL ENGINEER, Grade VI, £695-£760. Must have passed the Final Examination of the Institution of Electrical Engineers. Previous local government experience not essential. Applications, together with the names of three referees, to the County Architect, County Hall, Hertford, Herts, not later than the first post 19th July, 1954. 4037

DISCHARGE LAMPS

INDEPENDENT electric lamp manufacturers require TECHNICIAN fully conversant with all phases of manufacture of mercury and sodium discharge lamps.

Applicants should state experience, salary required, etc., to—Box 3962.

DIESEL-ELECTRIC MECHANICS

required by the FALKLAND ISLANDS DEPENDENCIES SURVEY for service in the Antarctic for a tour of 18 or 30 months in the first instance. Salary in scale £330 rising to £420 a year. Free passages, quarters, subsistence, clothing and liberal canteen stores; it is possible to save almost all emoluments. Liberal leave on full salary.

Candidates, between 20-26 years, must have a general working knowledge of electricity and be capable of running and maintaining small diesel generating sets with associated switchboards, accumulators, etc.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/30413/EF. 4018

STOREKEEPER

required by the ELECTRICITY AUTHORITY OF CYPRUS for two tours each of two years with either prospect of permanency and superannuation or on contract with gratuity of £100 a year).

Salary scale (including present temporary allowance of 15%) £877 rising to £1,012 a year. Annual bonus equivalent to one month's salary at present payable. Free passages for officer and family. Free furnished quarters or allowance in lieu. Liberal leave on full salary. Candidates, aged 28-35, must have held a responsible storekeeping position in an electricity undertaking or electrical manufacturing concern.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M1/34092/EF. 4078

VENNER LIMITED

require:

(a) ELECTRONIC ENGINEER conversant with design and manufacture of prototype transmitters, receivers, etc.
(b) ELECTRICAL ENGINEER for development work on small generators. Candidates should be suitably qualified.
(c) INSTRUMENT MAKERS for prototype development of mechanisms and light switchgear. Adequate experience is essential.

Rates of pay and conditions are good, posts (a) and (b) carry staff status.

Applications should be addressed to Personnel Manager, Venner Limited, New Malden, Surrey (MALden 2442). 3981

STANDARDS AND SPECIFICATIONS ENGINEER

INTERNATIONALLY known electrical engineering company seek to appoint a man between 30-35, with a general technical engineering background, and preferably with a degree or equivalent, for a senior position in the Central Standards and Specifications Office of the Company. Successful applicant will be required to assume full responsibility of the department in the absence of the Manager, and will be paid a salary commensurate with the duties involved.

Reply in confidence with full particulars of qualifications and experience to—Box 3984.

SOUTH WALES ELECTRICITY BOARD

CHARGEHAND LINESMAN required based at Lampeter in the Western Sub-Area.

Wages and conditions in accordance with the N.J.I.C. Agreement, 3s. 9d. per hour, 44-hour week.

Applications, giving details of present employment and previous experience, should be addressed to the undersigned to arrive by 17th July, 1954.

D. G. GWYN,
Sub-Area Manager.

South Beach Pavilion,
Tenby. 4023

SOUTH WALES ELECTRICITY BOARD

DISTRICT ENGINEER required in District 101/2 (Haverfordwest) in the Western Sub-Area.

Salary Class D, Grade 2 (£894/£925) of N.J.B. Schedule.

Applications, stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 17th July, 1954.

D. G. DODDS.
Secretary.

St. Mellons,
Cardiff. 4025

INSTRUCTOR (ELECTRICAL TRADES)

required for the GOVERNMENT TECHNICAL INSTITUTE, BRITISH GUIANA, on contract for three years in first instance.

Salary scale equivalent to £675 rising to £950 a year (including present temporary allowance of £50 a year). Gratuity of 22½% of basic salary drawn during contract. Free passages. Liberal leave on full salary.

Candidates must hold appropriate C. & G. Full Technological Certificate or H.N.C. and have at least 5 years' industrial experience including electrical installation work. Teaching experience is desirable.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30229/EF. 3977

A MAJOR British oil company requires for its overseas service an electrical engineer who would be responsible to chief electrical engineer for installation of generating and distributing plant, switchgear, motors, etc., and operation/maintenance thereof. Applicants must have served a recognised apprenticeship and hold H.N.C. or equal. Single men not over 28 preferred. Attractive salary, currently augmented by cost-of-living allowance; kit allowance; medical attention; pension fund; free furnished quarters and passages. Write, stating age, qualifications and full details of training and experience, to—Box E.R. 946, c/o 191, Gresham House, London, E.C.2. 3998

A SALES representative required for Midlands area by manufacturers of electrical domestic appliances. Applicants must reside in the area and state age, experience and salary required.—Box 9988.

A SENIOR electrical development engineer is required by a large manufacturing company of repute specialising in low-voltage equipment. The successful applicant, who should possess 10/15 years' experience with a wide background in electrical engineering, will be required to lead a team of engineers engaged on the design and development of rotating machines and electro-mechanical devices. This is a pensionable senior staff appointment and the starting salary will be commensurate with the position and the responsibility involved. Applications should be made in confidence, quoting reference G.L.E., to—Box 4041.

ALKALINE BATTERIES Ltd., of Redditch, are the largest makers in the Empire of alkaline accumulators, miners' lamps and emergency lighting systems, which are in rapidly growing use particularly for export. The company has vacancies in its technical sales and development sections for graduate electrical engineers, not over 30 years of age, or for men nearing the end of their degree course who have completed National Service. The posts are pensionable and offer the prospect of executive rank. Applications with full educational details and experience should be addressed —Commercial Manager, Alkaline Batteries Ltd., Union Street, Redditch. 3946

AN industrial organisation has a number of interesting vacancies for mechanical and electrical engineers. Applicants should be between 21 and 27 years of age and should hold an honours degree. Starting salaries in the range of £600 to £900 per annum depending upon qualifications and experience. Appropriate practical training will be arranged where necessary and normal salary will be paid during this period. Write, giving full particulars of age, qualifications and experience, to Box 3843, quoting advertisement reference O.6.

AN outstanding opportunity is available for a senior switchgear designer in an internationally known electrical engineering company for work on medium rupturing capacity oil-immersed and air break switchgear up to 11,000 volts. Successful applicant, who must be a fully qualified electrical engineer with complete experience, and capable of supervising others, will be paid a salary commensurate with the duties involved. This position has excellent prospects and offers a unique opportunity for the right man. Write in confidence, stating age, experience and qualifications, to—Box 3983.

AUTOPHONE Ltd., require qualified assistant engineer (degree or equivalent) for interesting and varied work on telephone and electronic equipment. Drawing office and workshop experience essential. Write fullest particulars to—539, Wandsworth Road, London, S.W.8. 3915

AN opportunity occurs in progressive manufacturing concern in London area for engineer aged 25/35 with electrical or physicist degree, on development and research work on high frequency telecommunication cable and associated testing equipment. Salary will be commensurate with qualifications and experience. Apply giving full particulars to—Box 3885.

ASSISTANT area managers. A leading electrical manufacturer with branches throughout the United Kingdom wishes to appoint assistant area managers in the following areas: Birmingham, Manchester, Sheffield, Leeds, Newcastle, Glasgow, Belfast and Dublin. Qualifications essential are: Strong connection in the area, and proof of exceptional sales record, age not over 45, and ability to organise and develop sales to all outlets. Remuneration will be at a minimum of £700 to commence according to qualifications. All replies will be treated in strictest confidence.—Box 7806, c/o Charles Barker & Sons Ltd., 31, Budge Row, London, E.C.4. 4001

ASSISTANT chief engineer required by company engaged in the design and development of guided weapons. Candidates must be mechanical engineers with first-class qualifications and experience in electronics and light engineering. Knowledge and experience in servo-mechanisms essential since duties would include responsibility for missile control systems, electrical gyros, accelerometers, etc. Applicants should be 30-35 years of age and have sufficient personality and experience to administer and organise the development activity on these subjects. Write in detail, quoting reference G, to—Box AC.91032, Samson Clarks, 57/61, Mortimer Street, London, W.1. 123

ASSISTANT chief inspector required for factory manufacturing light precision products. Knowledge of quality control methods and organization of modern inspection procedures for batch and flow production essential. The company operates a contributory pension scheme and there are good prospects of promotion. Apply with full particulars of age, education, training and experience with recent salaries earned to—Box 3964.

ASSISTANT engineer. Harrods Ltd. invite applications for the post of assistant mechanical engineer to control plant maintenance and new work. The applicant must have a degree or Higher National Certificate with works and drawing office experience. The post offered is permanent and pensionable and offers good prospects. Apply—Staff Manager, 44, Hans Crescent, London, S.W.1. 4002

B.B.C. requires electrical engineer with technical degree or equivalent qualification and practical training and experience in industry. Good technical and practical knowledge of switchgear, transformers, rectifiers, A.C./D.C. motors and generators, contactor and control gear, batteries, cables, etc., is essential. Knowledge of diesel engine equipment and of products of leading electrical manufacturers an advantage. Duties include estimating, specification writing, examining and summarising tenders. Salary £870 or £645 rising by 5 annual increments to max. £1,175 or £880 p.a. Applications to—E.E.O., B.B.C., London, W.1, within 7 days quoting ref. E.954 E.R. 3950

BRITISH West Africa. Large firm requires salesman for domestic and commercial/industrial electrical appliances department in British West Africa. Practical sales experience and some technical knowledge essential. Age 28/30 years. Pension scheme, free accommodation, good leave with free passages. Apply giving full details of previous experience and whether married or single.—Box 3965.

CAPABLE experienced man to take charge of electrical sales dept. of well-known E.W.F. Wholesalers (B'ham). Able to deal with quotations, correspondence and all matters pertaining to inside sales. High remuneration and ample scope for ability and initiative. Full details of experience to—Box 3888.

CHARTERED engineer with commercial experience for residence in Arabic speaking country to organise electrical mechanical sales of capital plant. Salient particulars only to—Engineer, G.P.O. Box 560, London, E.C.3. 4003

DRAUGHTSMAN, required young draughtsman for wiring diagrams and schematics, interesting variety work with prospects. West London area, convenient travel facilities. State age, education, experience.—Box 4049.

DESIGN draughtsman. A vacancy exists in our design drawing office for a first-class designer draughtsman for interesting work associated with the development of automobile electrical equipment. He should be at least of H.N.C. standard and experience in the design of light electrical equipment for large quantity production would be an advantage. The post provides excellent scope for initiative and advancement. Reply stating qualifications, experience and age, to—Personnel Manager, Joseph Lucas Ltd., Great King Street, Birmingham, quoting reference PM/D/93. 143

DESIGN draughtsman, experienced in layout of electronic equipment and test gear and with ability to design associated light electro-mechanical units and fabricated parts. London area. Good conditions and prospects for right man. Please state age, full details, past experience and qualifications.—Box 4048.

DESIGN draughtsman required for M.V. and E.H.V. switchgear; H.N.C. or equivalent. Salary commensurate with qualifications. Pension scheme. Apply—Chief Engineer, J. G. Statter & Co. Ltd., Amersham Common, Bucks, marked Confidential. 3796

DESIGNER draughtsmen required with mechanical and/or electrical experience. Good salary to experienced men. Manchester east area. Apply, in confidence, stating age, qualifications, experience and salary required, to—Box 4042.

DRAUGHTSMAN (junior) required by The General Electric Co. Ltd., for work connected with industrial heating, cooking and baking schemes. Applicants should not be older than 27 years of age, with O.N.C. standard and preferably some experience in this type of work. The position offers opportunities for progress with the sales organisation of the company. Apply in writing, quoting reference I.H., to the Staff Manager, Magnet House, Kingsway, London, W.C.2. 3919

DRAUGHTSMAN required for design and detail work on small electro-mechanical apparatus. Workshop experience and at least Ordinary National Certificate essential; 5-day week. Apply to the General Manager, Hendrey Relays Limited, 392, Bath Road, Slough. 4005

DRAUGHTSMAN required for transmission tower drawing office. Must be neat and efficient and have had experience and knowledge of electrical control equipment and circuits. Structural experience though an advantage would not be necessary for the work involved. Apply in writing to—J. G. Davies, Chief Electrical Engineer, Blaw Knox Ltd., 90/94, Brompton Road, London, S.W.3. 4004

DRAUGHTSMEN and designers, preferably with experience of mechanism or sheet metal work or electrical switchgear or control gear. Modern factory; good conditions; A.E.S.D. rates or above, according to experience and qualifications. Apply in writing to—Mr. Thomson, The Belmos Company Ltd., Industrial Estate, Blantyre, Lanarkshire. 3982

DRAUGHTSMEN. Previous experience in motor control equipment circuit work helpful but not essential if applicants are up to O.N.C. standard. Good salary and prospects. For successful applicants requiring housing accommodation, assistance may be given for skilled and key personnel. Pension scheme; 5-day week; canteen. Details of age, experience, qualifications and commencing salary to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 3449

ELECTRICAL and mechanical draughtsman wanted for manufacturing electrical engineers, West London district. State age, experience and salary.—Box 4044.

ELECTRICAL contractor requires estimator, hospitals, schools and textile work. Apply —Southern & Redfern Ltd., Woodhead Road, Bradford, 7, Yorks. 4045

ELECTRICAL draughtsman required for Persian Gulf by large oil company. Applicants should be under 35, with National Certificate and experienced in power and lighting installation drawing for industrial and domestic buildings, layout of L.T. and E.H.T. networks, and preferably preparation of bills of materials. Pensionable emoluments from £900 (incremental) plus substantial local living allowance, paid home leave (with passages) and at present no income tax. Bachelors preferred as no married accommodation available for first contract. Write, giving details and quoting No. 452, to—Box No. 7808, c/o Charles Barker & Sons Ltd., 31, Budge Row, London, E.C.4. 4043

ELECTRICAL development engineers are required for climatic testing of aircraft electrical equipment. The work will involve the running of high altitude and low temperature chambers and conducting tests on a wide range of equipment in this plant. Candidates should possess a Higher National Certificate in Electrical Engineering or its equivalent but less qualified engineers with sound practical experience will receive consideration. A knowledge of refrigeration would be advantageous but not essential. Applicants should write in the first instance, giving details of age, experience and qualifications, to—Box 3966.

ELECTRICAL draughtsman required Park Royal area. Should have experience in lighting and power installations for retail shops, manufacturing and processing depots; 5-day week; canteen. Good salary for suitable man. Pension scheme. Apply in writing, stating age and experience, etc., to—United Dairies Engineering Department, Cumberland Avenue, Park Royal, London, N.W.10. 3858

ELECTRICAL engineer, age 25-30, with good degree, preferably some experience in a research or development laboratory, is required for work on the application of electronic techniques to industrial measurement and control. This post is permanent, pensionable and offers good prospects. Apply in writing, giving full chronological details of qualifications and experience, together with age and salary required, to—Tube Investments Ltd., Dept. of Development and Research, Plume Street, Aston, Birmingham, 6, quoting ref. F.2. 9982

ELECTRICAL engineer required as assistant in section dealing with the design of power plant for telephone exchange contracts. Must have sound knowledge of A.C./D.C. control circuits. Write, giving full details of training and experience, to Personnel Officer, Ericsson Telephones Limited, Beeston, Nottingham. 4016

ELECTRICAL engineer for sales. Midland Silicones Ltd., an associated company of Albright & Wilson Ltd., require a qualified electrical engineer as assistant manager of the electrical department in the London office. The duties comprise the marketing of silicones to the electrical industry and provide great scope for the use of energy and initiative. Some travel is involved. H.N.C. in electrical engineering is a minimum qualification. Considerable experience in the use of insulating materials would be an advantage. Age 25-35. Good commencing salary and membership of non-contributory pension scheme. Apply to—The Appointments Officer, Albright & Wilson Limited, Oldbury, Birmingham. 3828

ELECTRO-mechanical draughtsmen required. Applicants should be up to O.N.C. standard. Good salary and prospects. For successful applicants requiring housing accommodation, assistance may be given for skilled and key personnel. Pension scheme; 5-day week; canteen. Details age, experience, qualifications and commencing salary to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 3450

ELECTRONICS. Electrical testers required who must hold O.N.C. or equivalent. Also required men with radio, radar or television experience for wiring and assembly of trays and panels. Please write or call—The Employment Office, The British-Thomson-Houston Co. Ltd., Rugby. 3829

ENGINEERING draughtsman (electrical) required for plant and services covering group of factories N.W. London. Should have sound engineering apprenticeship and plant experience. Knowledge of H.T. and L.T. distribution, lighting, heating and process plant controls. Progressive post involving design and supervision. Minimum £12 per 5-day week. Write details to—Box 2E, G7066, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2. 4011

FOREMAN supervisor experienced overhead transmission lines and underground cable work for contractors working Midlands and Southern England; also for work in Middle East and East Africa. Write details age, experience, etc., to—Box 3967.

GRADUATE apprenticeships in heavy electrical engineering. Vacancies occur in the General Electric Co. Ltd., Witton, Birmingham, 6, for university graduates in electrical or mechanical engineering who complete military service in autumn of this year. Further details and form of application may be obtained from the Staff Manager at the above works. 3951

GRADUATE electrical engineer with recognised apprenticeship required to undertake and ultimately be responsible for investigational test work on high-voltage apparatus, Manchester district. Please state details of training and experience and salary expected to—Box 3859.

INDUSTRIAL electrical and mechanical repair specialists require a young engineer representative for the London district. Applications in confidence to — London Sales Manager, Dowding & Mills Ltd., 26, White Post Lane, London, E.9. 4046

JOINTER and mates urgently required for long-term contract in Home Counties. Apply, giving details of experience and when available, to—Box 4047.

JUNIOR draughtsmen. Expanding company in W. London area has several vacancies with excellent prospects on forthcoming contracts for suitable applicants with some experience in light electro-mechanical equipment or electronic test gear. State age, technical training and experience.—Box 4050.

JUNIOR electrical engineer, 22/26, required to prepare control schemes, requisition electrical control gear and prepare diagrams for tracing for mechanised electric and gas-fired furnaces. H.N.C. desirable. Apply—Personnel Officer, Birlec Limited, Tyburn Road, Erdington, Birmingham, 24. 3968

KUWAIT OIL Co. Ltd. require an assistant radio engineer for service in Kuwait on the operation, maintenance and repair of marine and land radio communication equipment. Candidates must possess B.Sc. in electrical engineering or membership of the Institution of British Radio Engineers or Electrical Engineers, in addition have industrial experience on V.H.F. production development and be able to deal with all types of low and medium powered transmitters and receivers. Knowledge of hospital and other electronic equipment an advantage. Age under 35. Salary starting £830 p.a. clear plus generous allowances, pension scheme and kit allowance. Write for application form giving brief details and quoting K.1808 to—Box D/68, c/o 191, Gresham House, London, E.C.2. 3986

LAYOUT draughtsmen required by consulting engineers for electrical layout work including H.V. and L.V. outdoor substations, indoor switchgear and cable diagrams. Applicants should possess or should be studying for H.N.C. or equivalent. Salary in accordance with qualifications. Apply in writing, reference KJB/RFS, to—Messrs. Kennedy & Donkin, 12, Caxton St., Westminster, London, S.W.1. 4007

MATERIALS clerk. Young man with works and drawing office experience on small electro-mechanical apparatus required. To prepare schedules of materials from drawings and to progress these from suppliers; 5-day week. Apply to the General Manager, Hendrey Relays Limited, 392, Bath Road, Slough. 4006

MECHANICAL engineer with good technical qualifications required for 80-MW industrial power station. Age not less than 30. Commencing salary £950 to £1,100, with generous non-contributory pension scheme. Up-to-date and responsible power station experience essential. Apply in writing to—Salaried Personnel Department, Ford Motor Company Limited, Dagenham, Essex, quoting reference PHE. 3987

MOTOR winding foreman required by West London firm. Progressive permanent post for fully experienced man able to carry out without supervision rewinds, repairs, etc., all types motors, fractional to 10 h.p., A.C. and D.C.—Box 9997.

PLUMBER-jointers required for work in Home Counties. Good conditions and permanent employment.—Box 3830.

POWER cable development engineer required for research and development of H.V. cables and accessories. B.Sc. Engineering desirable. Previous experience not essential. Salary in accordance with qualifications. Apply, stating age, qualifications and salary required, to—Personnel Manager, Standard Telephones & Cables Ltd., North Woolwich, London, E.16. 3999

PRODUCTION supervisor. A vacancy offering scope for progress is available for suitable applicant having experience in production of tape and wire-wound electrical elements and a good knowledge of electrical domestic appliances. Commencing salary £850. Write giving full details of past experience, age, etc., to—Box 3744.

PURCHASING officer required with sound experience in purchasing wide range of materials for mechanical and electrical engineering trades. Pension scheme; house available. Apply, stating age, experience and salary required, to—The Secretary, E. R. & F. Turner Ltd., Foxhall Works, Ipswich, Suffolk. 3817

REPRESENTATIVE required by established electrical and radio wholesalers. Good connections essential. Further details from—Reigate Electrical Co. (Wholesale) Ltd., [illegible] London Road, Reigate, Surrey (Reigate 487[illegible]). 9950

REPRESENTATIVES required for the following areas by manufacturers of electric lamps, automobile and miniature bulbs: Manchester, Liverpool, Leeds, Blackpool area, Glasgow, North of Scotland, Kent, Gloucester and Somerset. Tremendous scope and opportunities for keen conscientious workers. Good salary. Permanency. Commission and car expenses. Preference given to men with lamp selling experience. Write, stating experience and all details, to—Box 3963.

REPRESENTATIVES with established connections required to promote new and first-class electrical domestic equipment. Car owners essential. Must be able and willing to work hard. Full support given. Write full particulars to—Napper, Stinton, Woolley Ltd. (BP), 14-9, Gt. Chapel St., London, W.1. 40[illegible]

REPRESENTATIVES (2) required for London by leading manufacturers to call on wholesalers; take over existing connection. Full particulars—Metway, Brighton. 39[illegible]

SENIOR draughtsmen required for switchgear and control gear. Candidates for these positions should be experienced, and preferably hold the H.N.C. Five-day week, good canteen and other welfare facilities. Non-contributory pension scheme. Apply to—Personnel Dept., George Ellison Ltd., Perry Barr, Birmingham, 22B. 40[illegible]

SWITCHGEAR draughtsman, experienced in layout and diagram work for general contract work, required by electrical engineering company, Manchester area. Good conditions and prospects. Please state experience, age and salary required to—Box 3890.

TECHNICAL assistant required, age 20-25, West London, to work under Chief Draughtsman and assist with compilation of component and material schedules, technical records and standards, and administration of expanding drawing office. O.N.C. standard with some workshop experience desirable. Company's products include precision light electro-mechanical and electronic equipment. Excellent prospects. State full details, age, education, experience, and starting salary required. —Box 4051.

TECHNICAL assistant required for training as a lamp works engineer. Initial work will be on preparation of specifications. Every opportunity will be given for advancement on technical side. Applicants with O.N.C. or equivalent should write to—Personnel Officer, Osram-G.E.C. Lamp Works, Hammersmith, London, W.6. 3923

TENDERING engineer required by manufacturers of electrical rotating machinery. Previous experience in this field is essential and education to O.N.C. standard desirable. Five-day week; non-contributory staff assurance scheme. Salary according to qualifications and experience.—Box 3891.

THE DISTILLERS Company Limited require for their Engineering Division, London office, senior and junior electrical draughtsmen for power and lighting layouts, with a knowledge of flameproof installation and equipment for industrial and chemical plants. Technical qualifications required are H.N.C. for senior and O.N.C. for junior draughtsmen. Replies giving full details of experience, qualifications, age and salary required should be addressed to—The Appointments Secretary, The Distillers Company Ltd., Engineering Division, Southern Office, Devonshire House, Mayfair Place, Piccadilly, London, W.1. 3765

THERMO-couples. Instrument operative with skill and knowledge in the construction of very fine wire thermo-couples in vacuo. A generous salary is offered, and a house available. Interview in London. Location East Coast, 90 minutes London. Reply, stating post experience, age, number in family and salary expected, in strict confidence, to Managing Director.—Box 3969.

THE advertisers, an old-established light electrical engineering firm, N.W. area, have immediate vacancies for draughtsmen (section leaders, seniors and juniors) who have experience in (a) chassis and rack design or (b) small electro-mechanical devices. All these posts are permanent and offer good prospects and attractive remuneration to those selected for appointment. Write, stating age, education, qualifications and experience, in confidence, to—Box 3721.

THE EAST AFRICAN POWER & LIGHTING Co. Ltd. require for service in Kenya, a technician experienced in the installation and maintenance of power line carrier current equipment. The successful applicant will be expected to work also on electronic voltage regulators, communication systems and power system protective circuits, etc., but he need not necessarily have had previous experience of these provided he is willing to learn. Salary £720 p.a. plus marriage allowance £100 p.a. (if applicable). Cost-of-living allowance up to approximately £90 p.a. Free housing or allowance of 20% of basic salary in lieu. Free medical attention and electricity and contributory pension scheme. Apply to—The East African Power & Lighting Co. Ltd., 66, Queen Street, London, E.C.4. 3985

WANTED, first-class electricians with contracting experience preferably. Good opportunity and permanency for suitable men. Good prospects. Apply—Lee, Beesley & Co. Ltd., 6, Warwick Row, Coventry, or Lee, Beesley & Co. Ltd., 41, Snow Hill, Birmingham, 4. 3733

YOUNG engineer, O.N.C. standard or equivalent, required for transformer testing. Excellent prospects. West London area. Write, stating age and experience, etc., to—Box 4008.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

A GOOD all-round electrician. Technical education. Age 33 years. Car owner. Position with prospects.—120, Abbeville Road, London, S.W.4 (MACaulay 1645). 9976

CHIEF electrical engineer with large engineering firm in East of Scotland desires change of position preferably, though not essential, as a technical representative.—Box 9993.

DOMINION Govt. executive (A.M.I.Mech.E., A.M.I.E.E.) seeks U.K. post where comprehensive engineering and overseas experience useful. £1,500.—Box 9979.

ELECTRICAL contractor's engineer, fully experienced all classes of work, planning to final account, expert draughtsman, sixteen years last post, seeks senior or managerial position nr. Manchester area.—Box 9983.

PUBLIC school education, age 34, engineering and sales at home and abroad, experience in communications, requires senior position in London area.—Box 9984.

QUALIFIED elect./mech. engineer. Exp. management, technical, production, design on motors, etc., light engineering, control gear, gearing, foundry. Pres. sit. Essex/London.—Box 9975.

SUCCESSFUL young sales manager requires change with good prospects. Would welcome opportunity to prove himself, i.e., the marketing of new products. Experienced in domestic appliances; 8 years' practical experience electrical engineering. Would consider position overseas.—Box 9989.

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MODERN, 400/3/50, fully reconditioned. All sizes, ¼ to 75 h.p. Offered at one half the makers' price. Control gear available. List or quotation by return.

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TENDERS are invited for the undermentioned electric equipment. Full details are as follows:—

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Makers: W. SISSON & CO. LTD., Gloucester. Installed: 1920. Steam driven tandem engine, single crank. H.P. Cylinder, 6¼" dia. L.P. Cylinder, 9" dia. Stroke: 5" B.H.A. 32 W.P. 100 lb. per sq. in.

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D.C. Generator, No. 65114. Makers: SIEMENS BROS. Type: 260 F.C., kW 20, Amps. 185/125, Revs. 575/590, Volts 108/145 Field shunt.

GENERATOR, No. 1225.

Makers: ASHWORTH & PARKER. Single crank tandem engine. Installed: 1935. H.P. Cylinder 4½" dia. L.P. Cylinder 7" dia. Stroke 5"

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D.C. Generator, No. 138. Makers: MAWDSLEY LTD., Dursley, Gloucester. Frame 1405. Date: 1935. Volts, 100/150, Amps., 200/133, R.P.M. 600. Complete with switch panels.

LAUNDRY ENGINE (STEAM), No. 48103. Makers: ROBEY & CO. LTD., Lincoln. Horizontal type, Approx. 25 h.p.

Forms of tender may be obtained on application to the Supplies Officer at the undermentioned address.

Tenders on the prescribed form, enclosed in the envelope provided and bearing no name or mark indicating the sender, must reach the undersigned not later than the 20th August, 1954.

The Committee do not bind themselves to accept the highest or any tender.

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Group Secretary.
Windsor Group Hospital Management Committee,
Kipling Memorial Building,
Alma Road,
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A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

ALTERNATOR control panel cubicles, 1,000 kW, 500 kW, 250 kW, 150 kW, 3-phase, 440 volts.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 31

ALTERNATORS for sale from ½ kVA to 500 kVA, all voltages, single and three-phase, complete with exciters, automatic voltage regulators and switchboards. Low prices, guaranteed for one year.—Fyfe, Wilson & Co. Ltd., Bishop's Stortford. 4059

A.C. and D.C. house service-meters, all sizes, quarterly and prepayment, reconditioned, guaranteed one yr. Repairs and recalibrations. —The Victa Electrical Co., 47, Battersea High Street, S.W.11 (Tel. Battersea 0780). 138

ALTERNATORS, 2 to 30 kW, 1 and 3-ph., and D.C. generators, 300 w. to 24 kW. Lists.—Powerco Ltd., Wandsworth Town Station, York Rd., London, S.W.18 (Vandyke 5234). 151

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 33

AUTO-synchronous motor by Crompton Parkinson, 220 h.p., 500 revs., 3-phase, 50 cycles, 400 volts, with controller.—Thomas Mitchell & Sons Limited, Bolton. 3871

BARGAINS in electric motors are always being obtained from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Stocks include A.C. and D.C. motors, second-hand and new up to 30 h.p. Starters, slide rails and pulleys. Ring Mon. 3355 for your requirements. 50

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CIRCUIT breakers, 300 amps., 3-phase, 50 cycles, Crompton Parkinson clad type, floor mounting, 25 MVA rupturing capacity. Number available. — Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 21

COMMUTATOR type variable speed A.C. motor by B.T.H. 20/10 h.p., 1,400/700 revs., 3-phase, 50 cycles; 400 volts, moving brush type. 5 h.p., 1,200/600 revs. by Metro-Vick, moving brush type with pilot motor.—Thomas Mitchell & Sons Limited, Bolton. 3869

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DIESEL generating sets, English manufacture, 3-phase, all sizes to 500 kW.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 16

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

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Our sales have continued at a high level, and 20% of the turnover was exported. We are finding that competition is very keen for export business, particularly from Germany. The work we have in hand will keep us busy for the remainder of the current year, but prices are much keener and we are finding new business more difficult to secure.

I think we can attribute a great deal of our success to constant work on development, for, in proportion to its turnover, your company spends much on development and is well known for so doing.

I referred in 1951 to the establishment, in partnership, of a factory in Sydney, Australia. Progress is being made there and we think that eventually it will be very successful, especially as the Australian Government places very great importance on local manufacture.

The Canadian branch in Toronto continues to be active, but we are finding the preference for American equipment difficult to overcome. However, I am of the opinion that in time this too will be a successful venture.

I must refer to the heavy burden of taxation which all industry has to bear. It appears to me to be very bad finance on the part of the Government to take away the life blood of industry, which is productive, and spend the money on non-productive activities. Looking ahead this heavy taxation is bound to have a very severe effect on the country's economy, for if part of the amount paid away in taxes were utilised in industry it would produce revenue, provide employment, and everyone would be better off.

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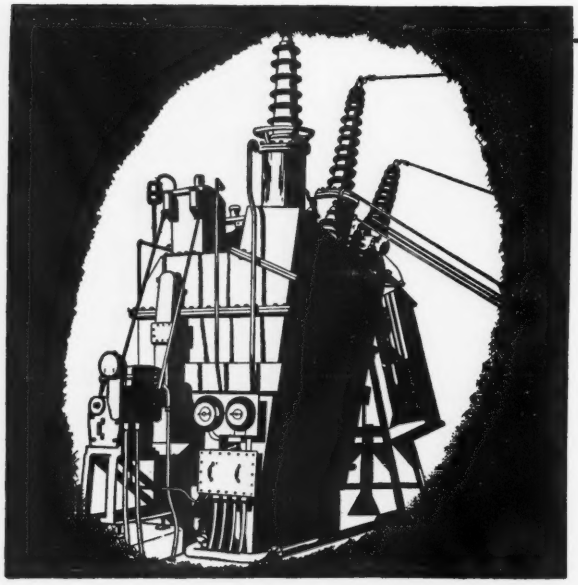

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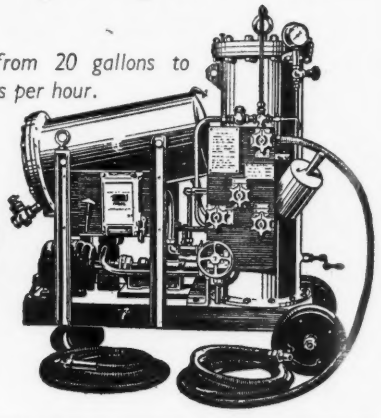

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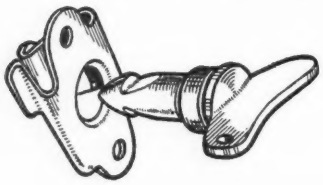

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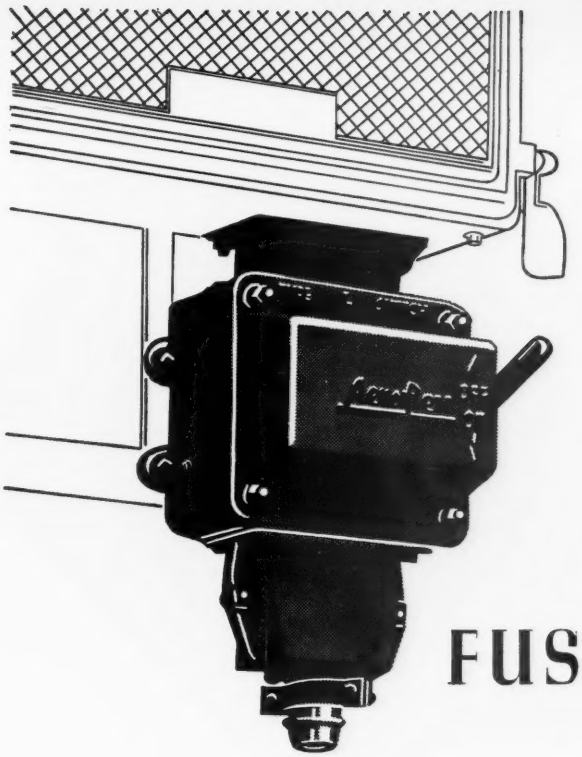

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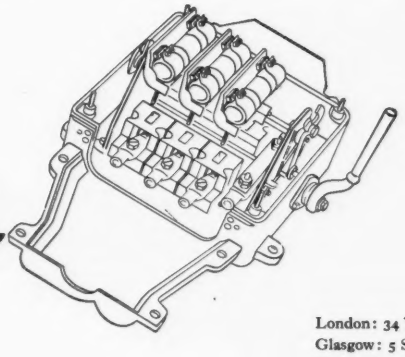

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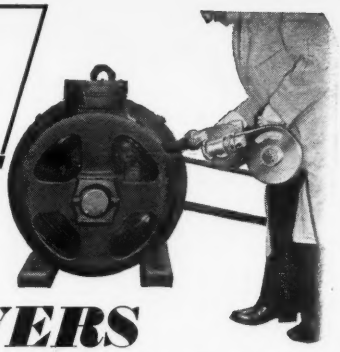

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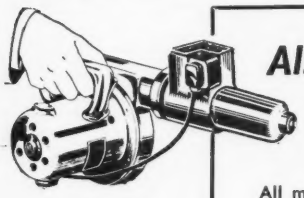

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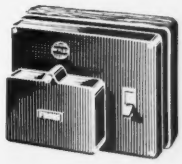

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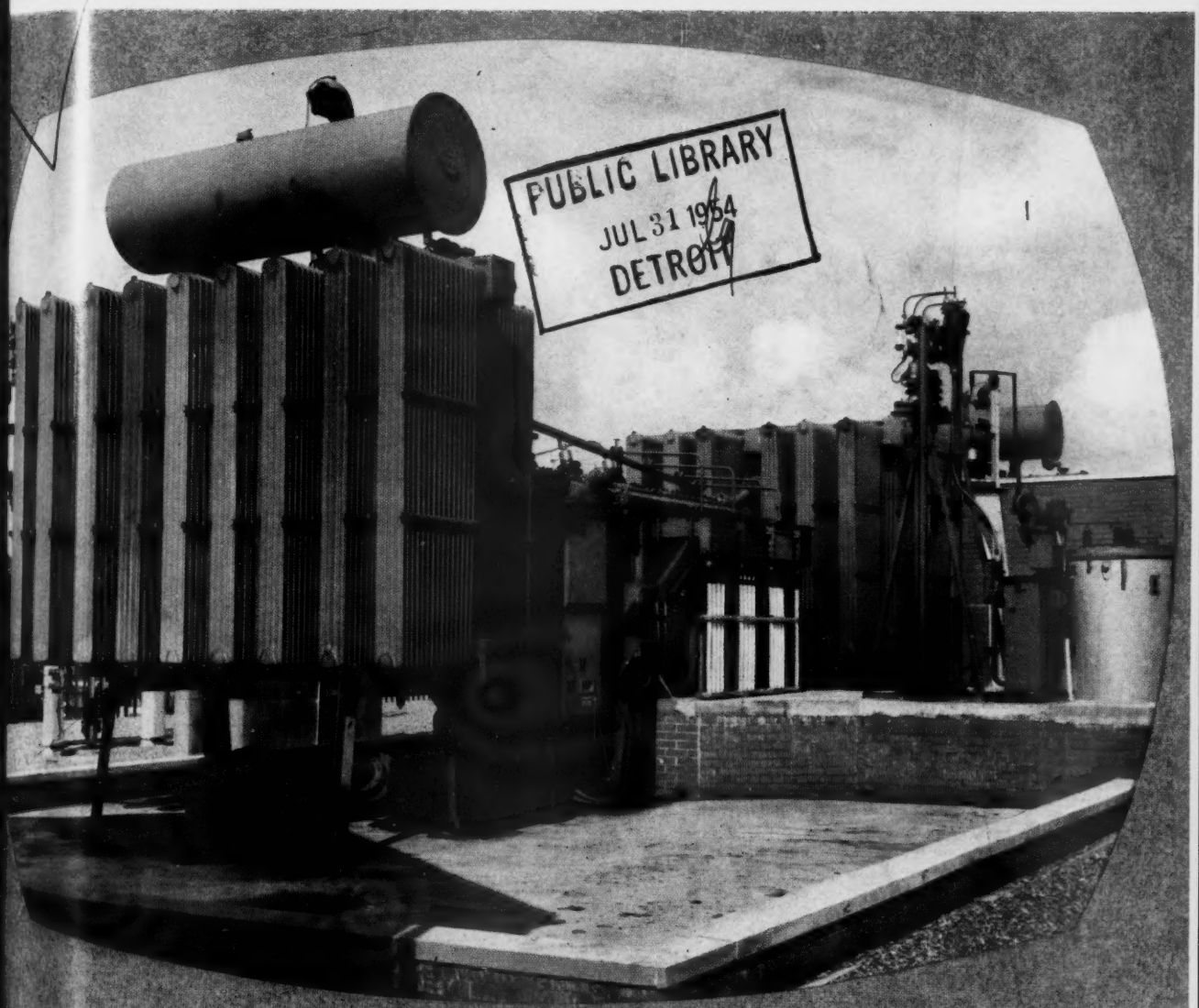

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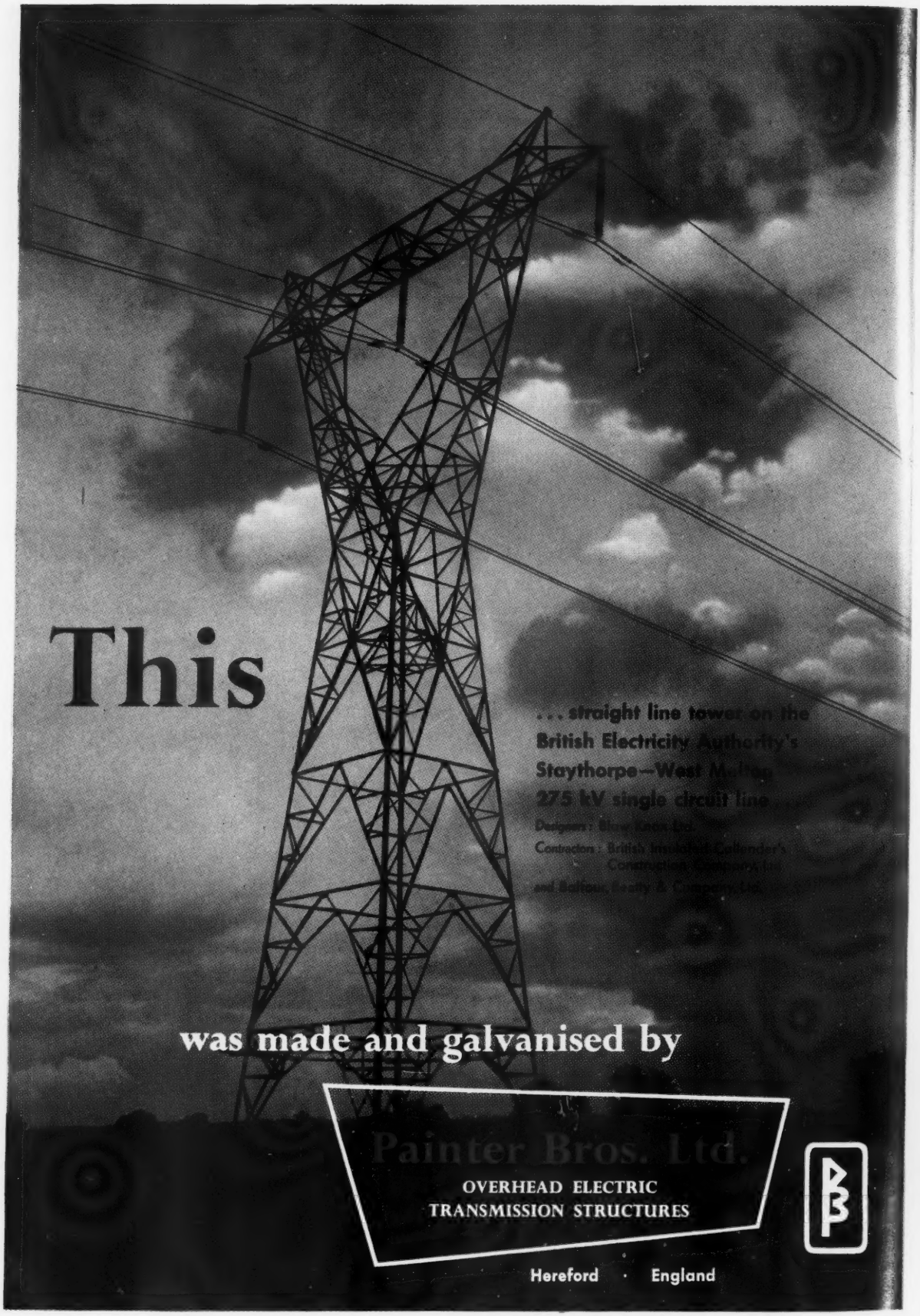
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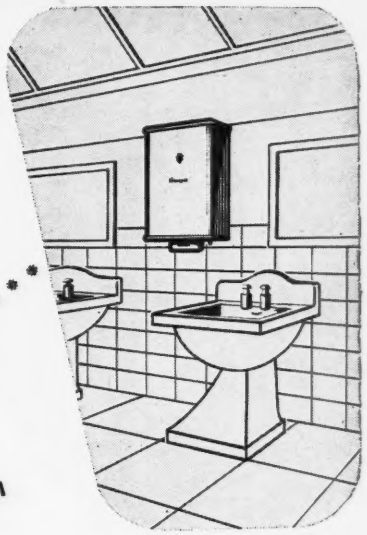

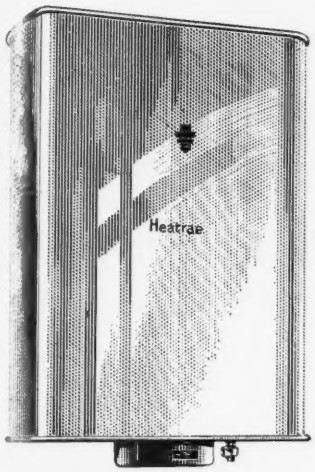

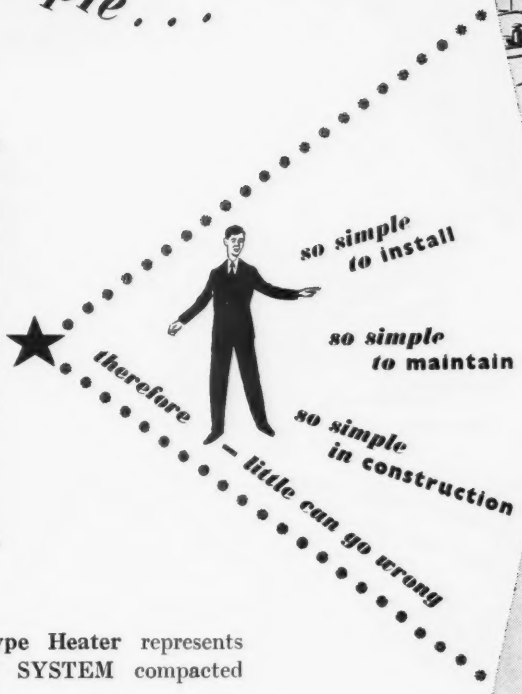

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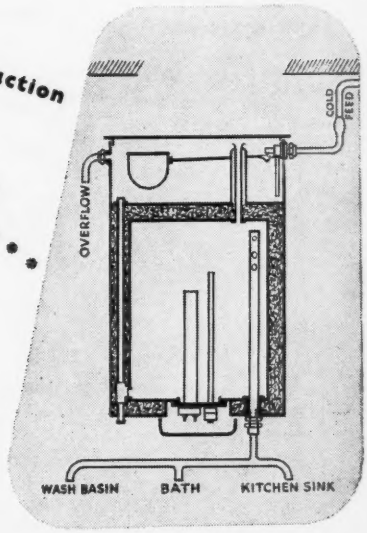

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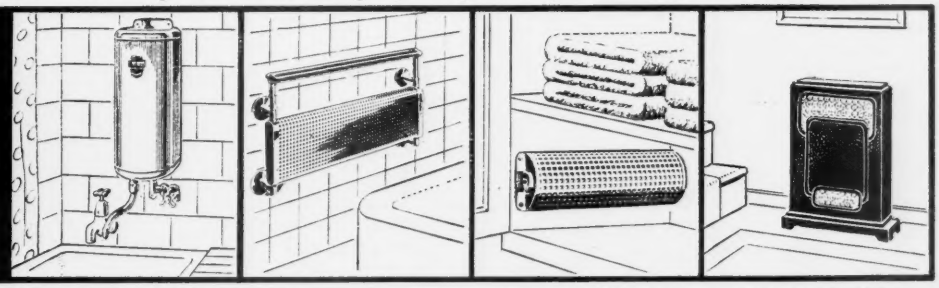

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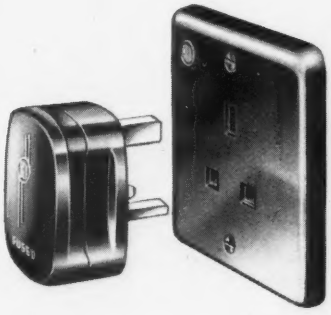

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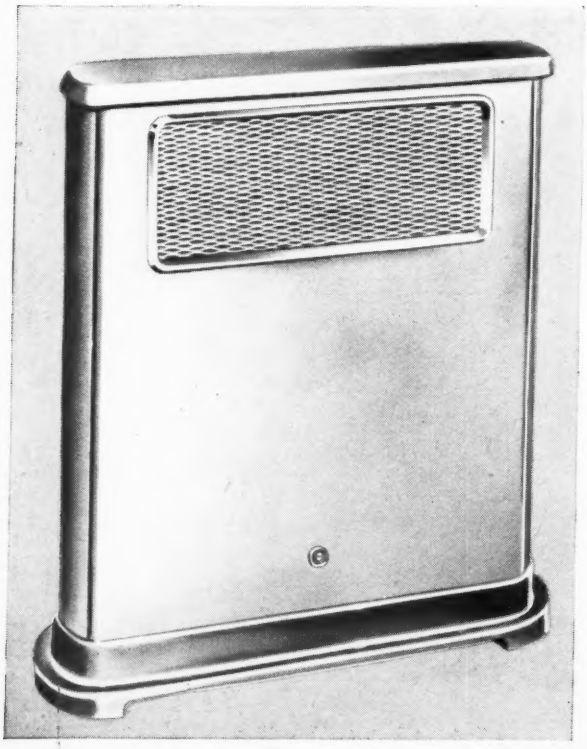

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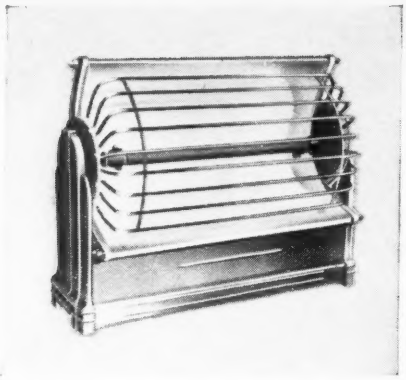

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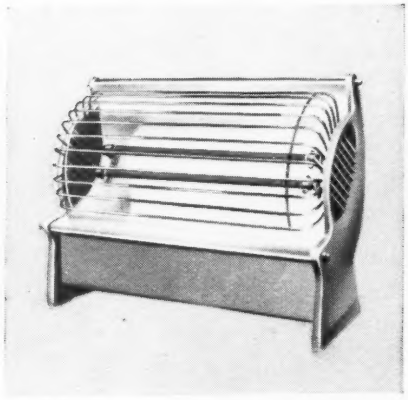

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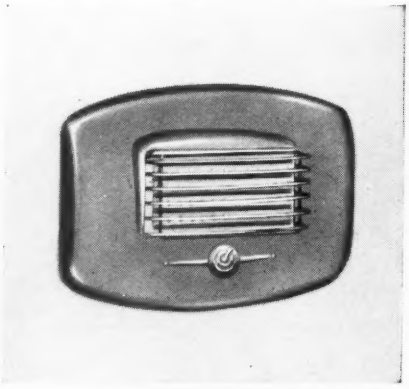

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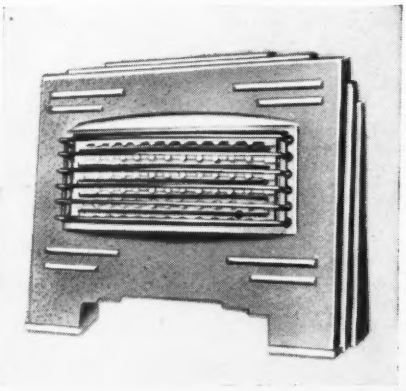

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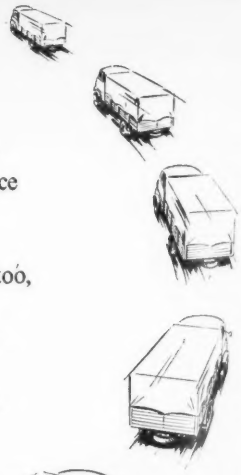

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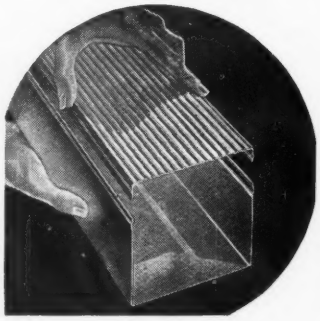

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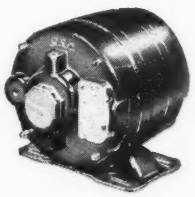

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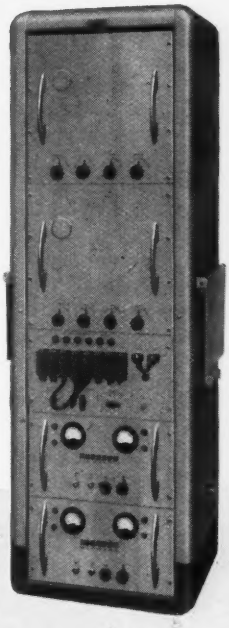

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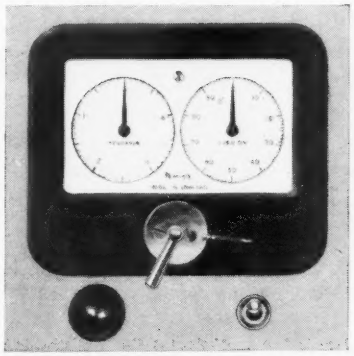

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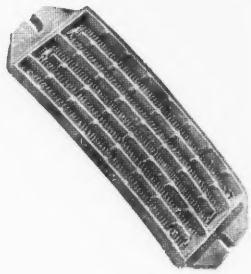

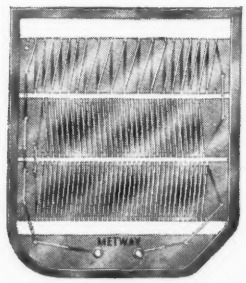

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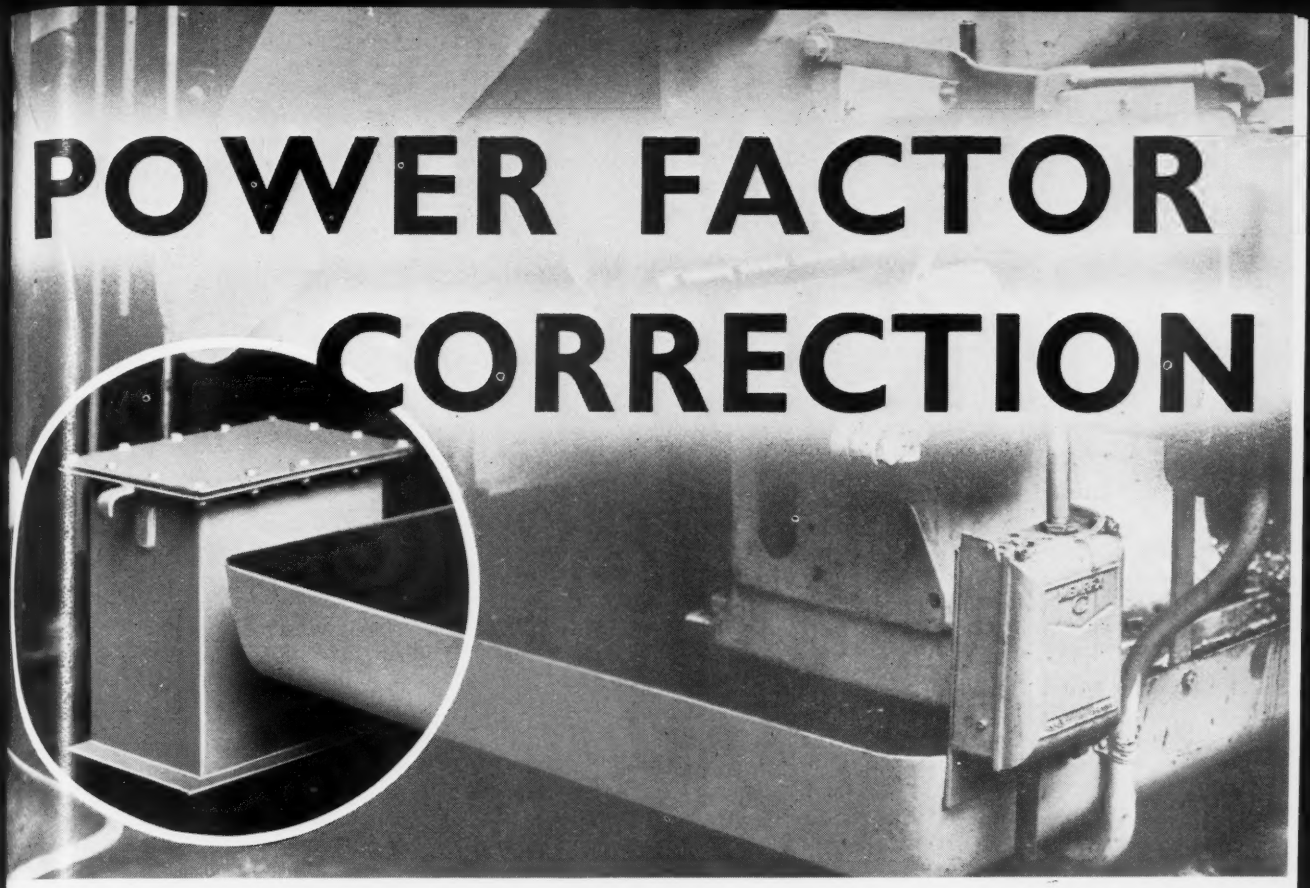

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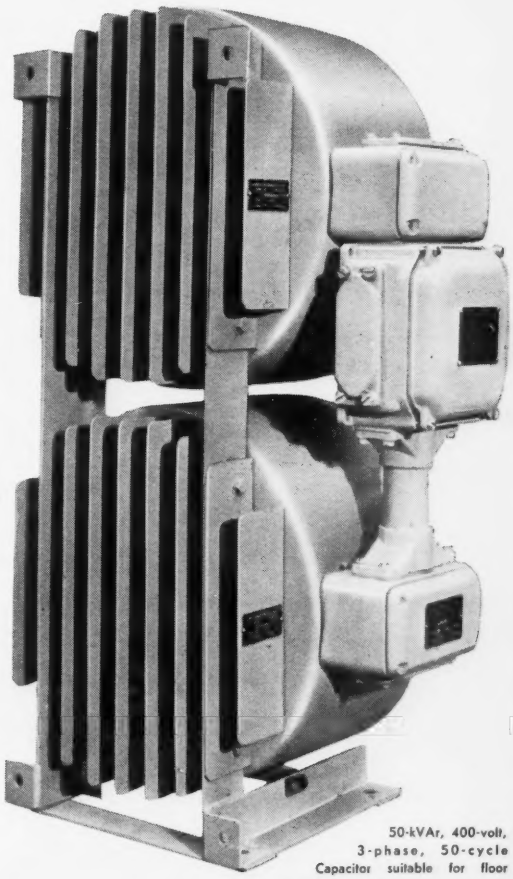

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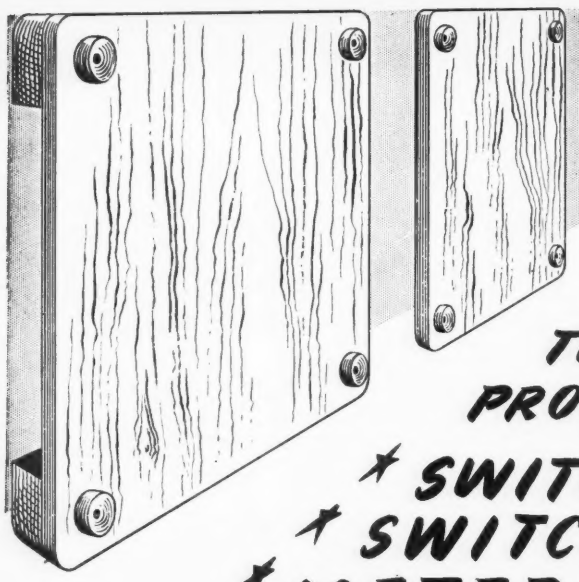

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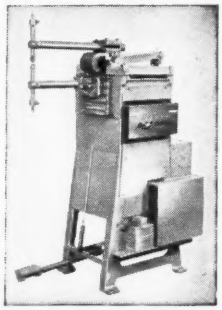

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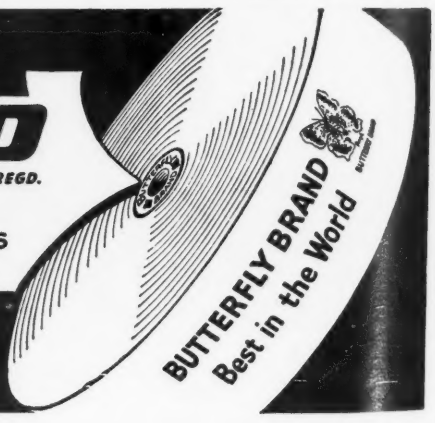

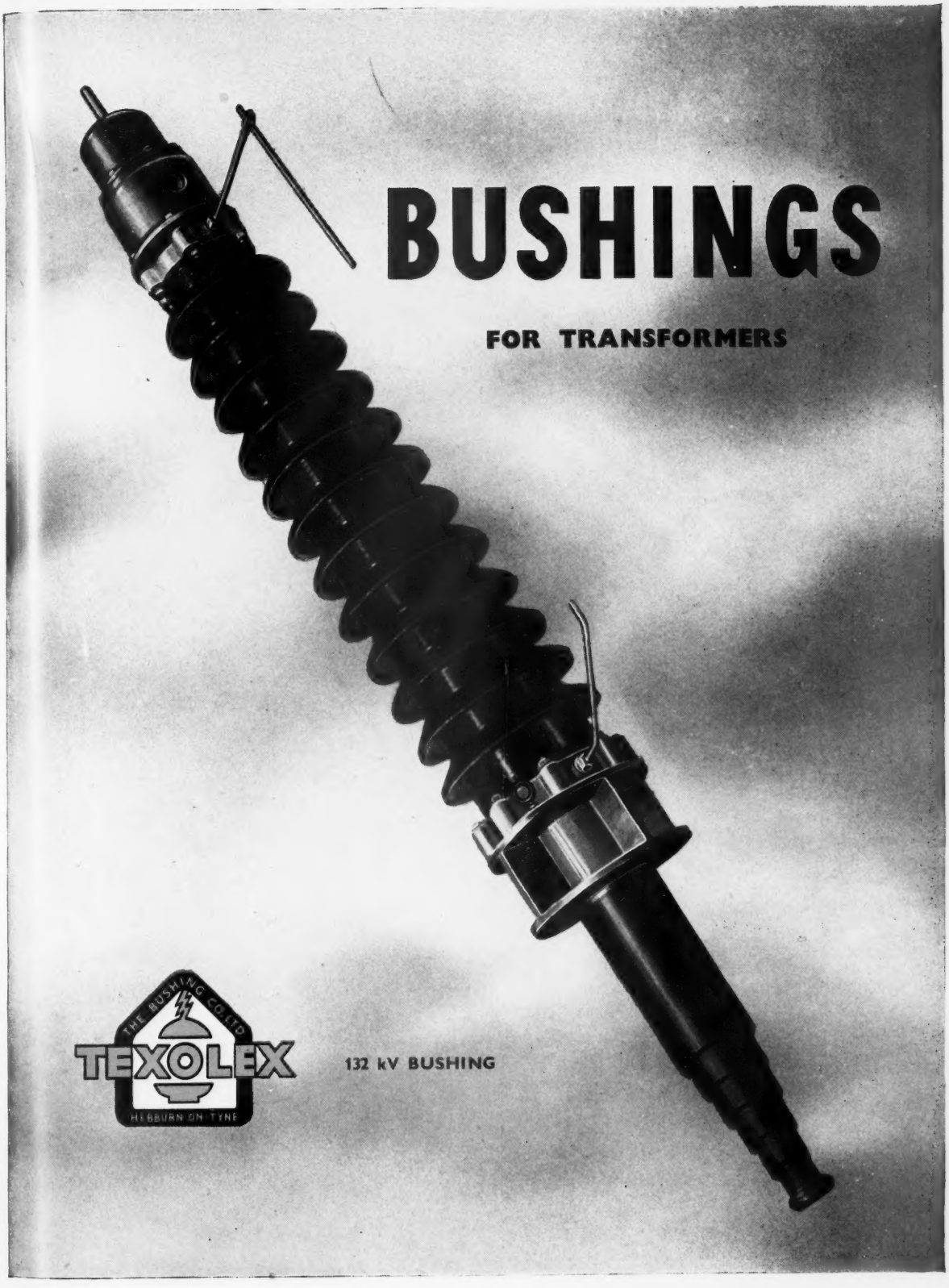

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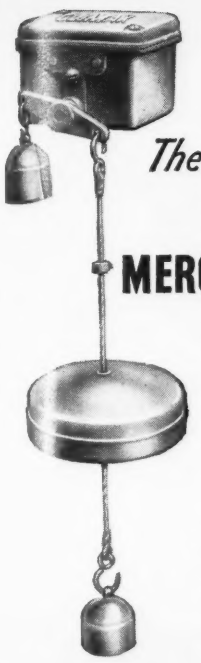

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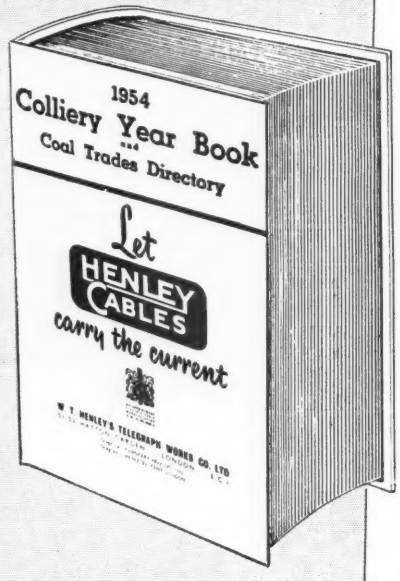

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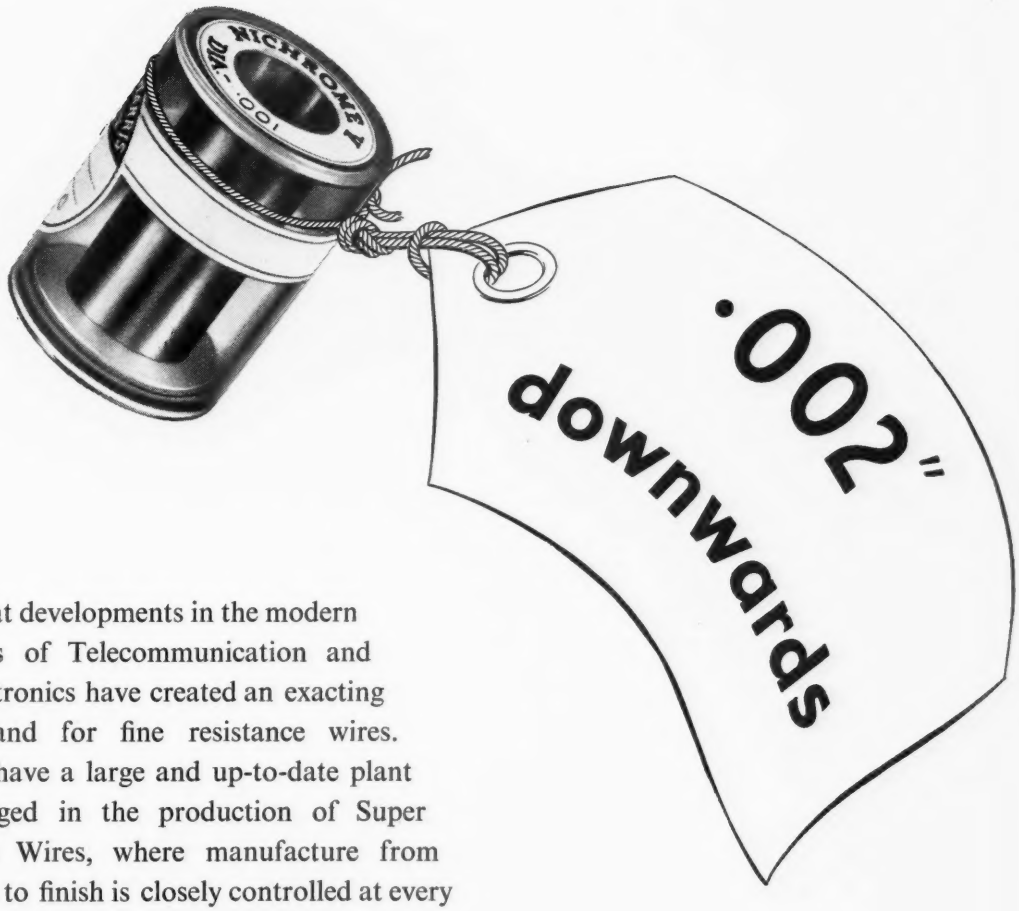

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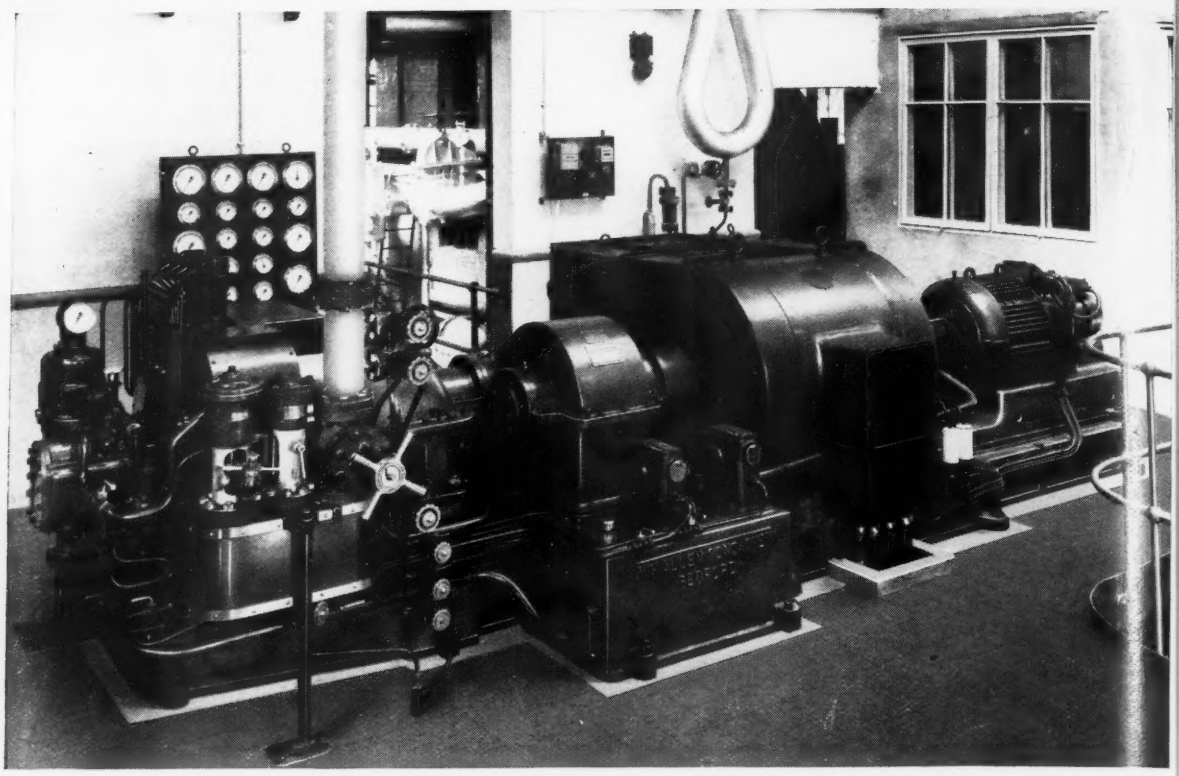

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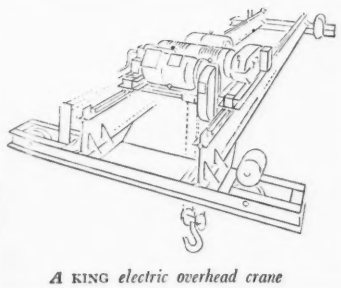
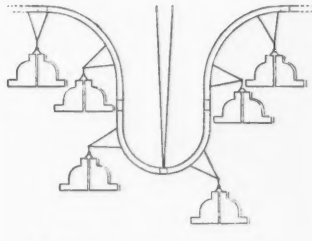


A KING *electric overhead crane*



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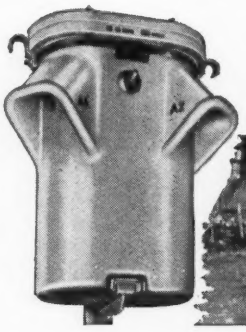

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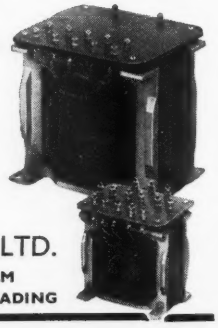

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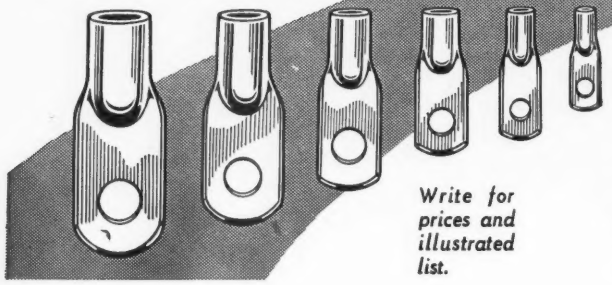

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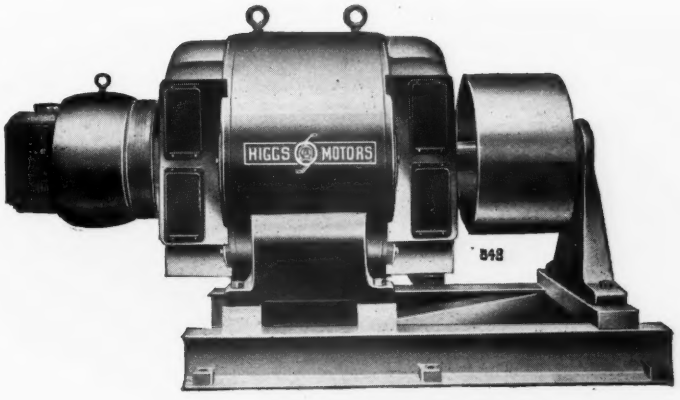

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Both these switches have self-cleaning wiping contacts

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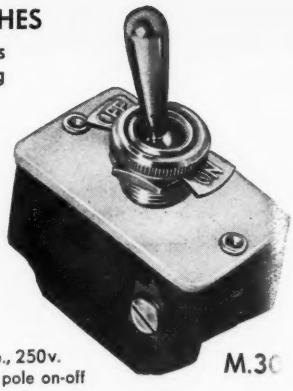
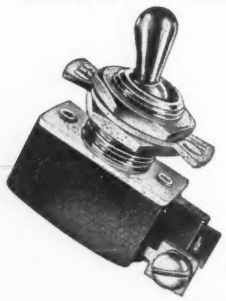
Entirely new
D.P.C.O. or D.P.S.T. switch



10-amp., 250v.
Single pole on-off

M.3(

MINIATURE TOGGLE SWITCHES



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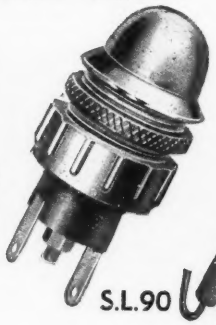

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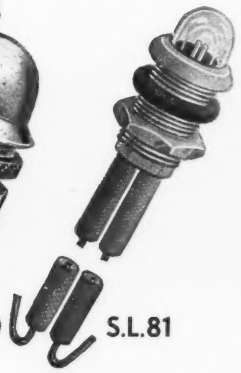

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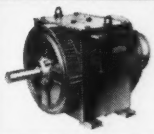
the	BRUSH		Square	Path
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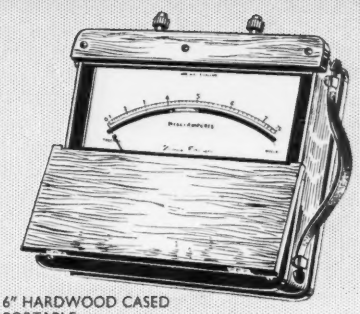

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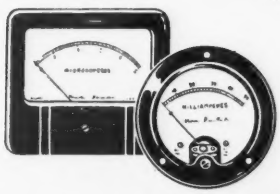

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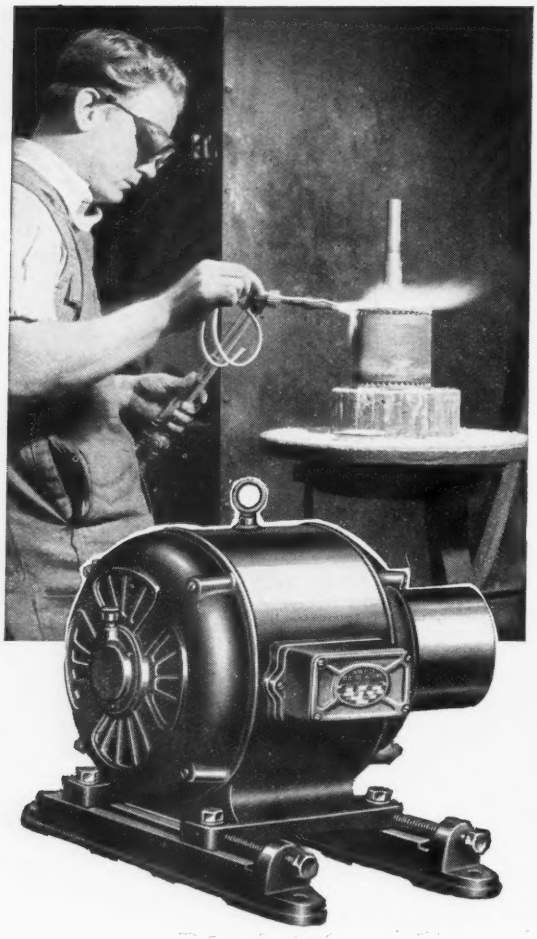

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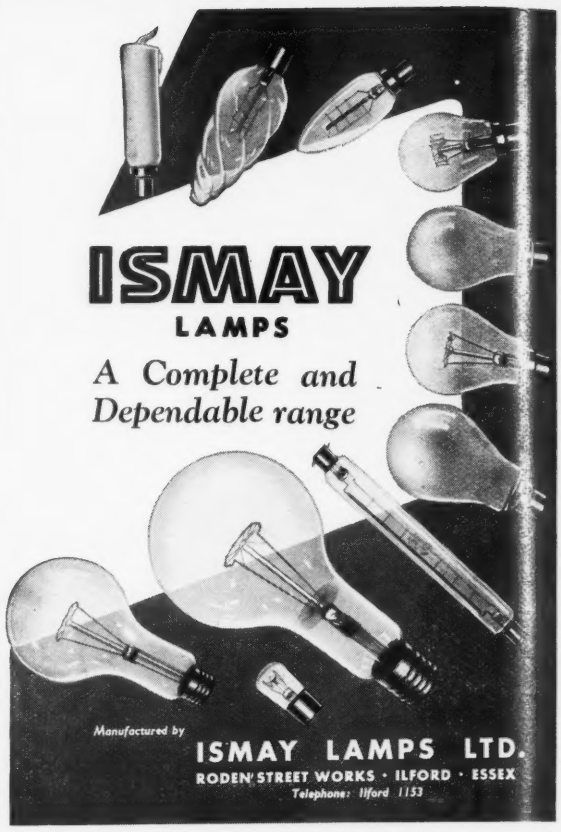

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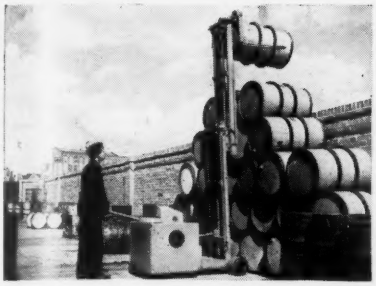

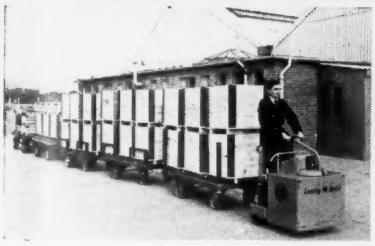

Lansing Bagnall first manufactured electric trucks in this country in the early 1920's. The Company was reorganised in 1943 and, in 1949, moved to a new factory at Basingstoke. Progress was rapid, and the above photograph shows a recently erected bay to the factory, providing a further 25,000 square feet of uninterrupted floor space. This bay, and Lansing Bagnall trucks themselves, are wired with St. Helens Cables.

Architects : C. W. Glover & Partners.
Electrical Contractors: Electrical Equipment (Leicester) Ltd.

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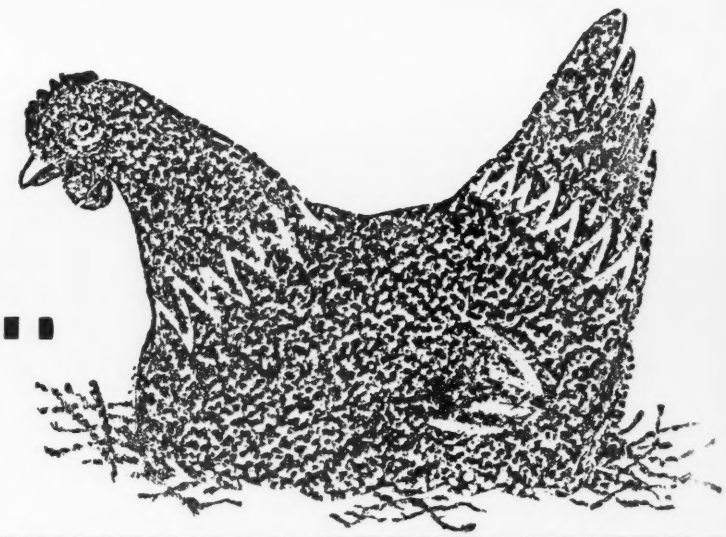
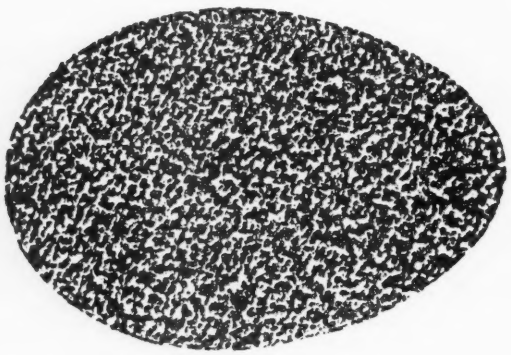
The Hen...





or the Egg ?

Which came first? It's quite a query, since each connotes the existence of the other. And so it is with packaging: the processes from first to last are interdependent. Inner carton or outer case. Wax-wrapping or labelling. Market presentation or tropicalization. REMPLOY P.I.P. SERVICE *includes them all.* It is ready to lay a preliminary design before you or to hatch out a complete packaging plan worth clucking over!

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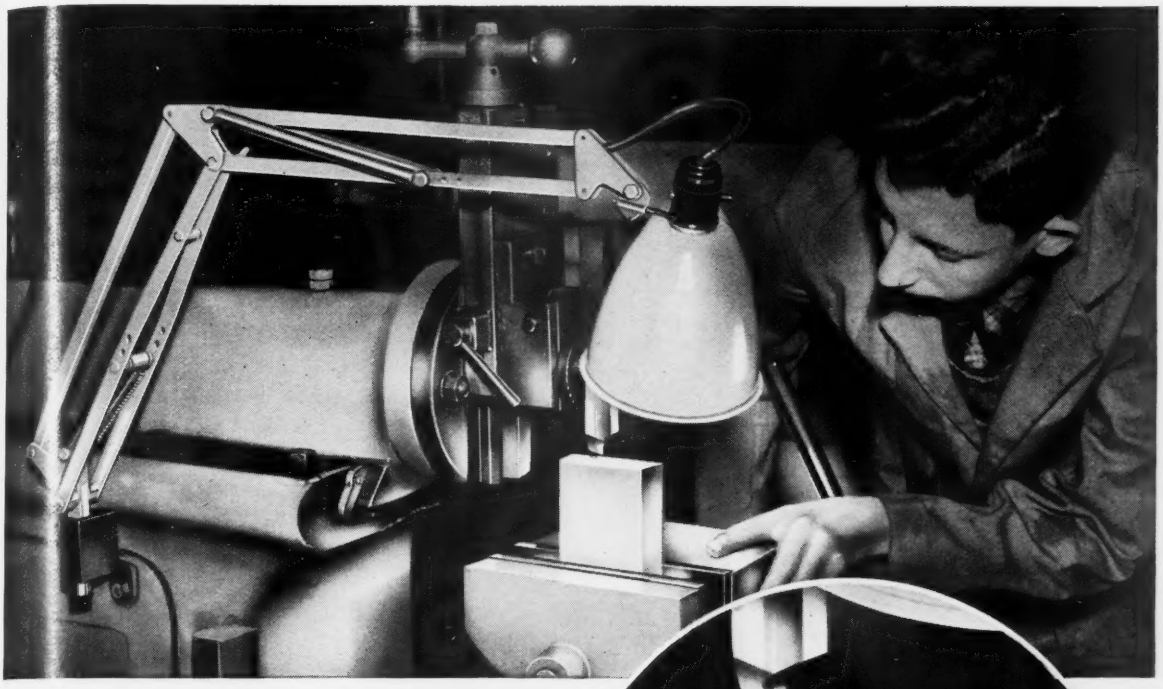
How's this FOR CONCENTRATED WORK LIGHT?



Down a little!

Still nearer!

Right on the job!

AN OPERATOR working under the best working conditions does a better job. Give your operatives ANGLEPOISE Lamps on their machines, it will pay dividends in accuracy and output. This lamp has everything — instant adjustability, throws a clear concentrated beam right on the work, 'follows' the job at a touch, takes and holds any required angle, moves out of the way as required.

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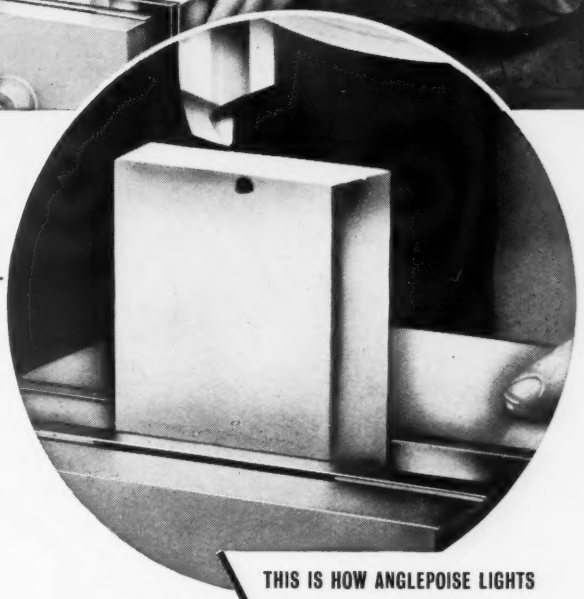

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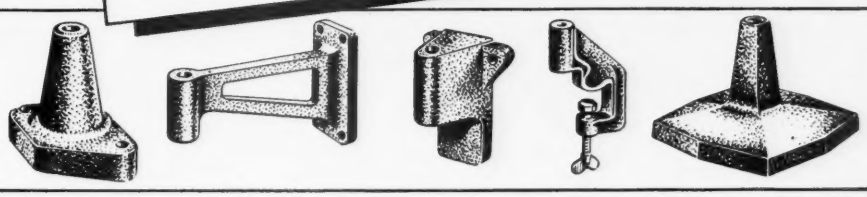
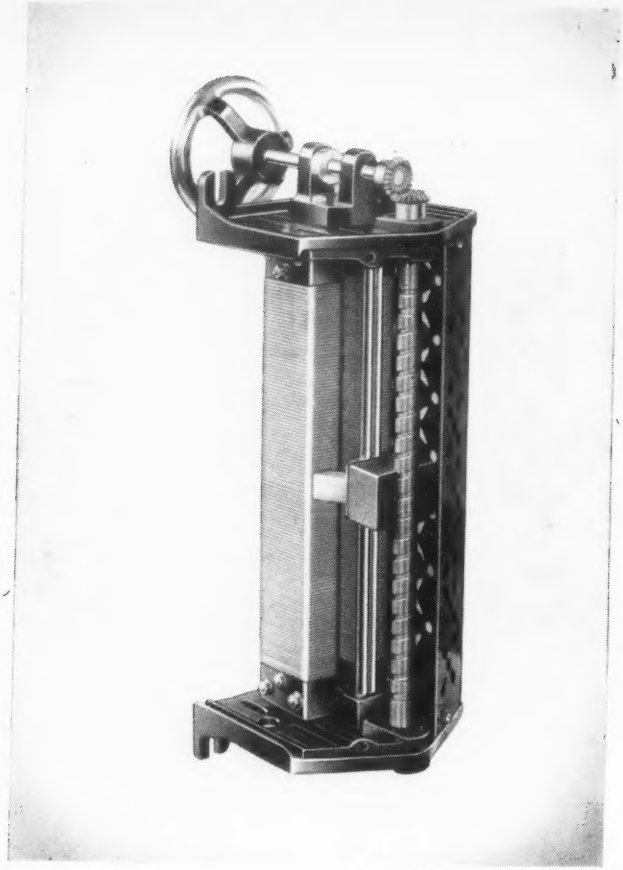


HT8



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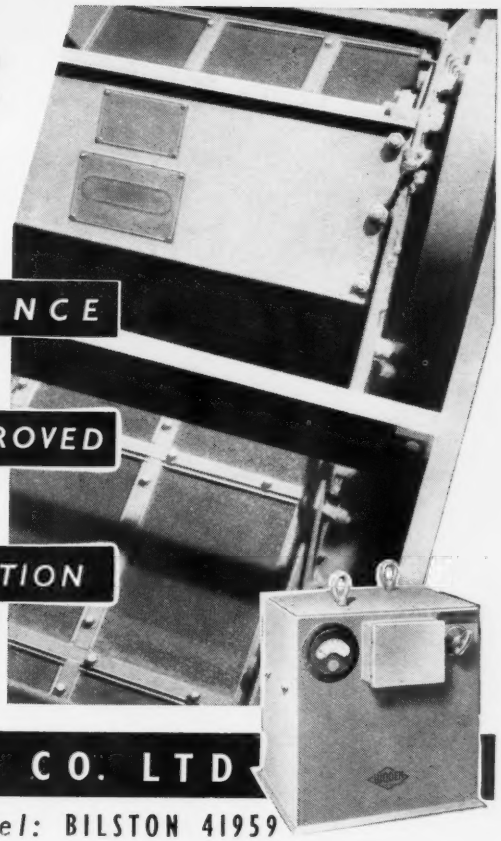

** Illustration of screen, with heat on, showing absence of blinding.*

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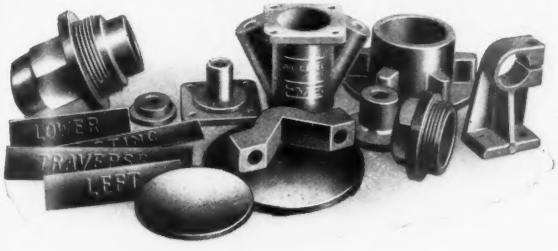

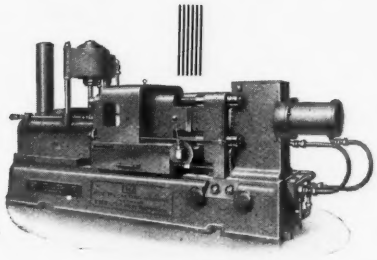

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We take our own medicine

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May we send a catalogue?—or better still, come and see the machine working

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Die Casting Machines, Injection Moulding Machines, Air Presses, Air Equipment, Flexipress Straightening Machines, Electric Control Gear

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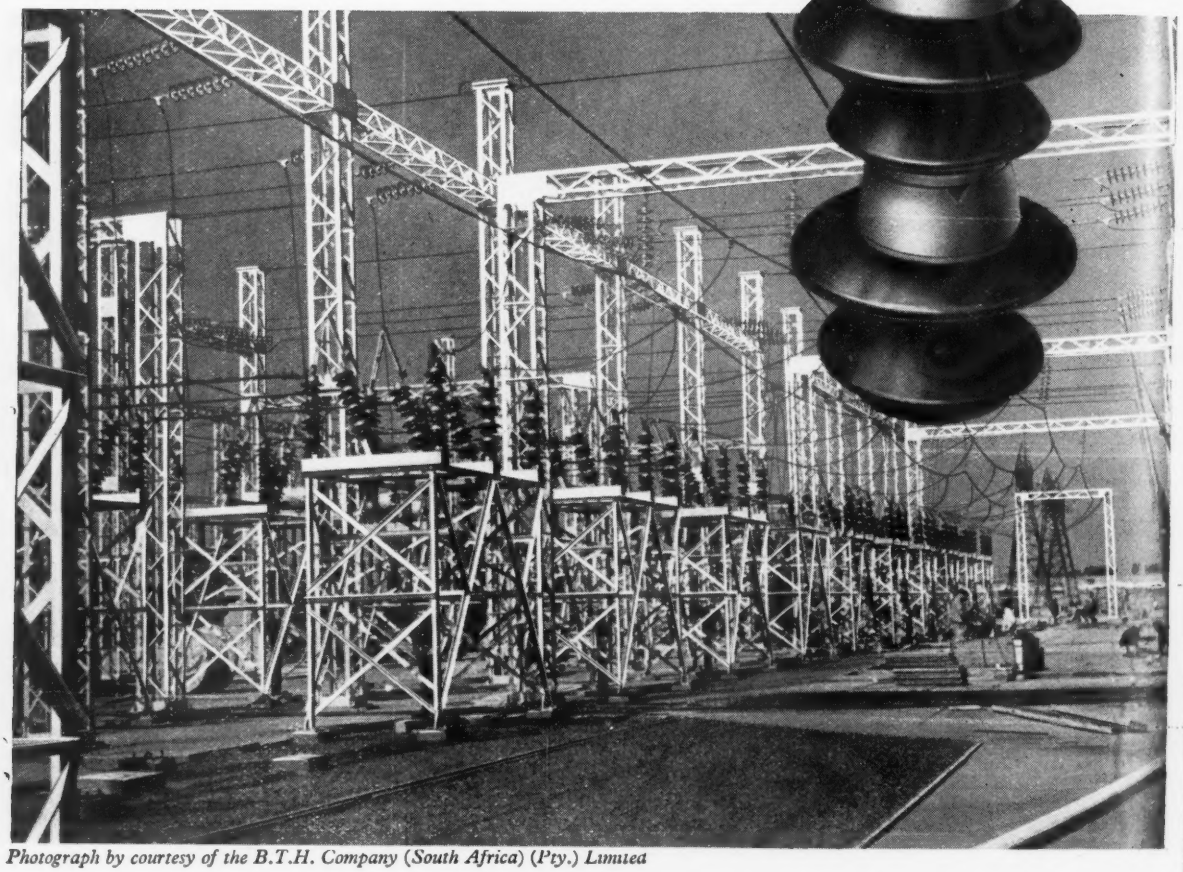

Photograph by courtesy of the B.T.H. Company (South Africa) (Pty.) Limited

The 88 kV. Switchyard at Vierfontein Power Station of the Electricity Supply Commission (Rand Undertaking) is one of many for this Authority insulated with S.P.P. Posts of 4-units P.642.

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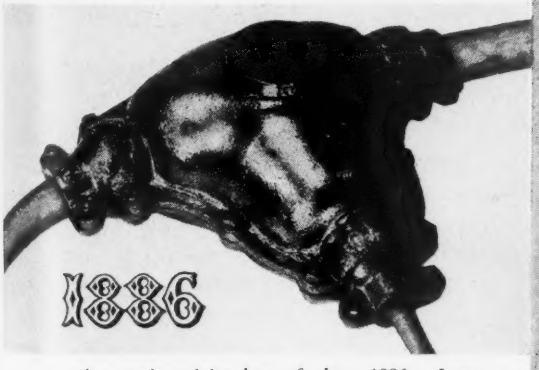
A catalogue of medium-voltage joint boxes is available on request. Please ask for Publication No. 309.



A cast-iron joint box of about 1886. *Large numbers of these gave completely satisfactory service in early low-voltage networks in London and other principal cities. They were employed in conjunction with the Edison Tubular Main Operating at* 110*v D.C.*

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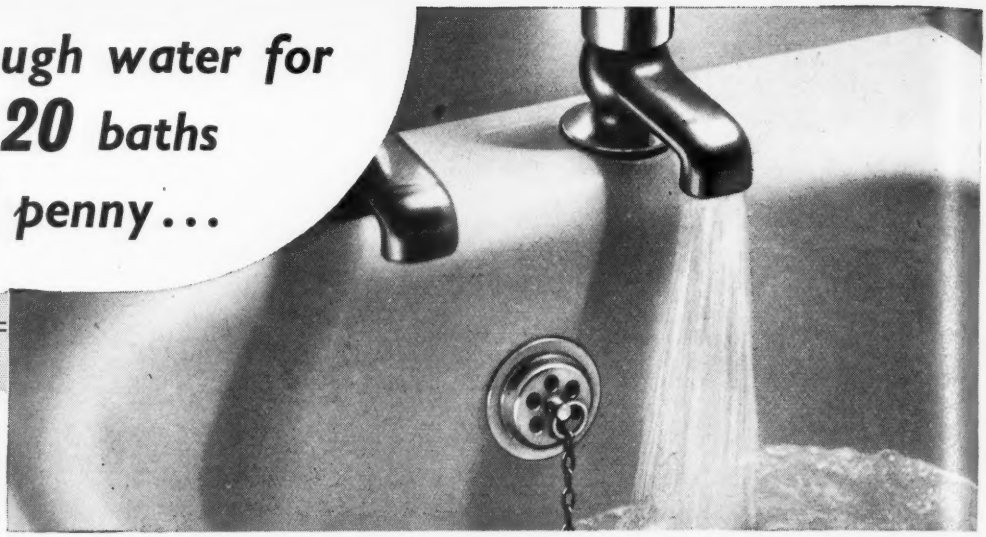

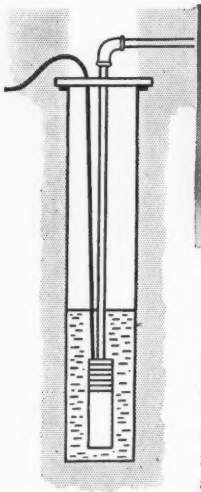

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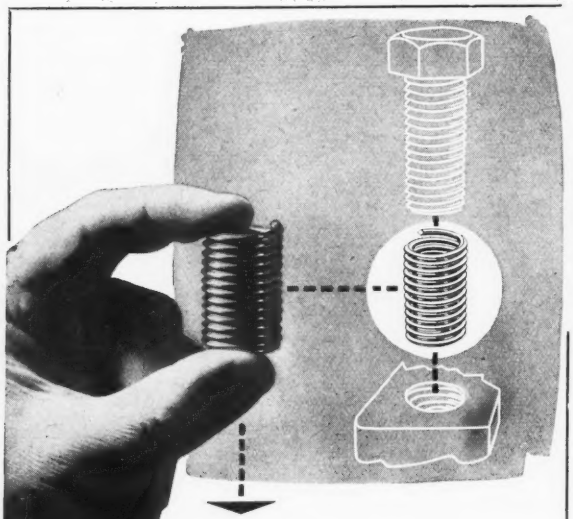

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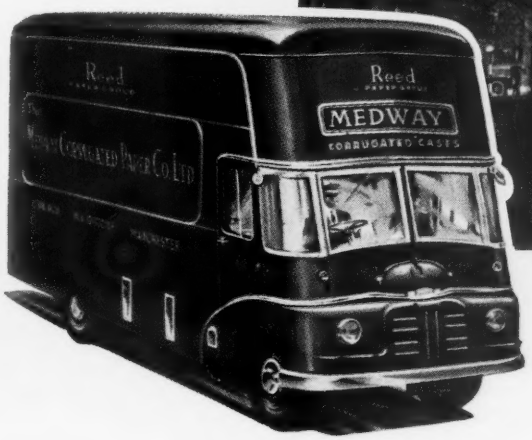

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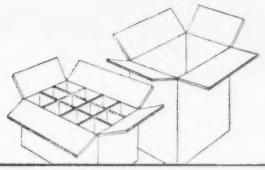

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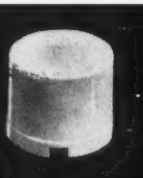

Fig. 384
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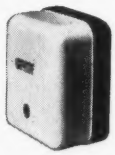

Fig. 1139 TRANSFORMER*
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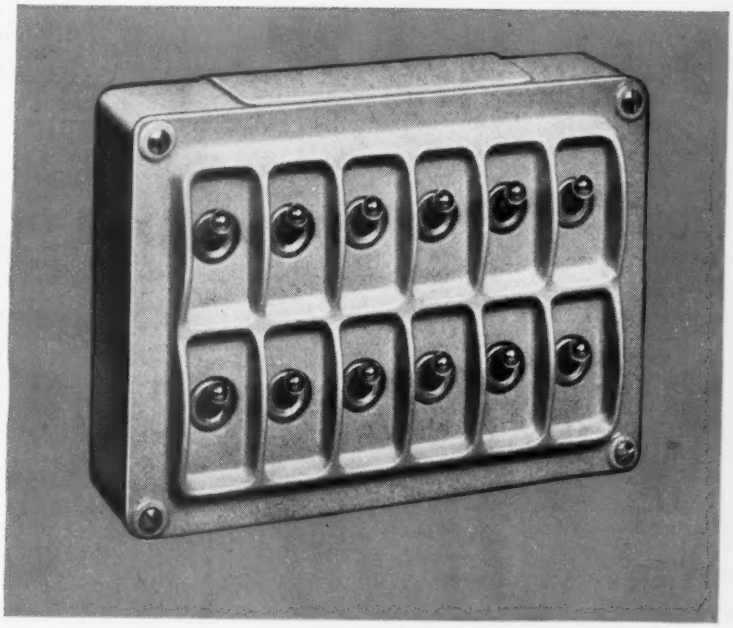

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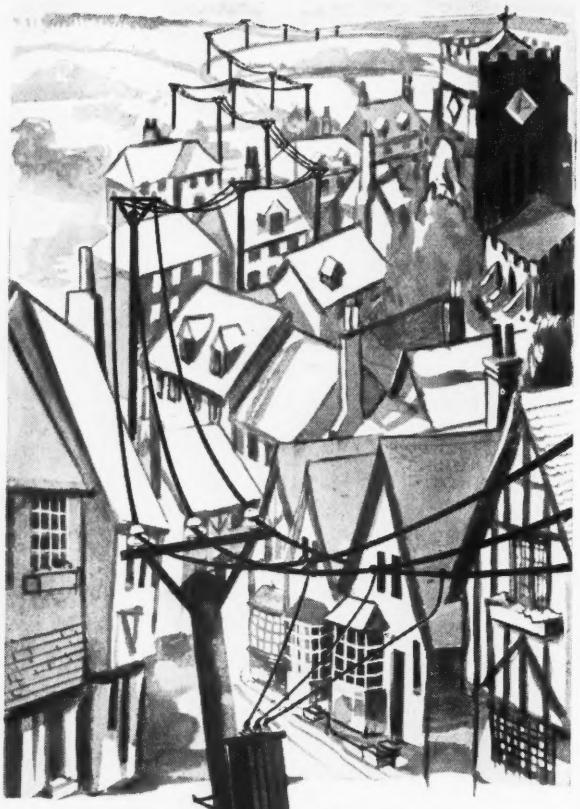

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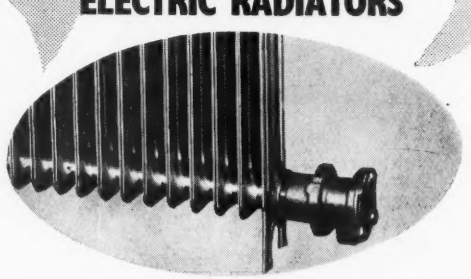

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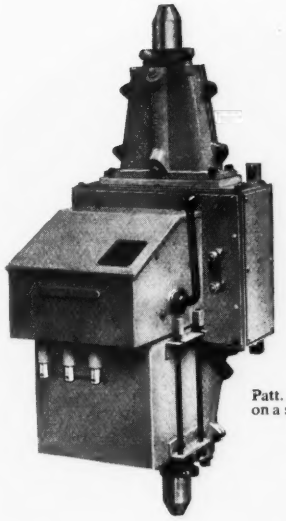

Patt. "B" is mounted on a separate connection chamber.

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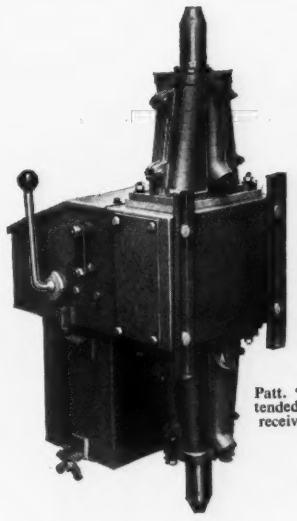

Patt. "D" has an extended top chamber, for receiving connections.

"FD" Oil Circuit Breakers are of the triple pole pattern, and complete with three adjustable overload trips also adjustable oil dashpot time lags. An external Neutral Link is provided, when required, for the fourth wire. Both patterns can be supplied with pedestals for floor mounting. Pattern "D" can also fit beneath a Busbar Chamber.

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Patterns "B" and "D" meet most requirements, but Oil Circuit Breakers with draw-out isolation gear, and for Switchboard and Cubicle mounting are also included in the "FD" range. Standard ratings:—100, 150, 200, 300, 400, 500 and 600 amps.

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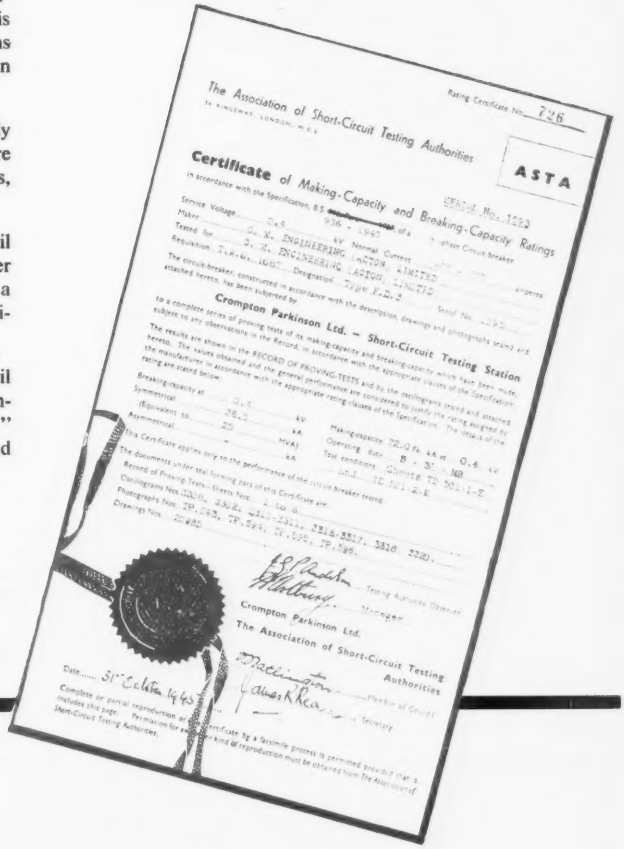

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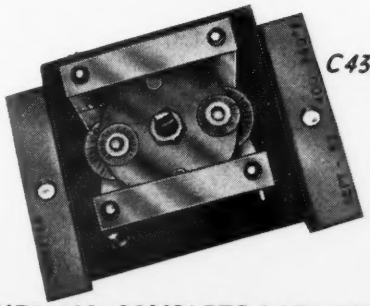

C4351 2POLE TYPE

C4351 SINGLE POLE TYPE

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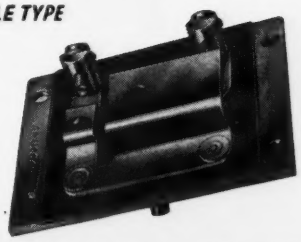

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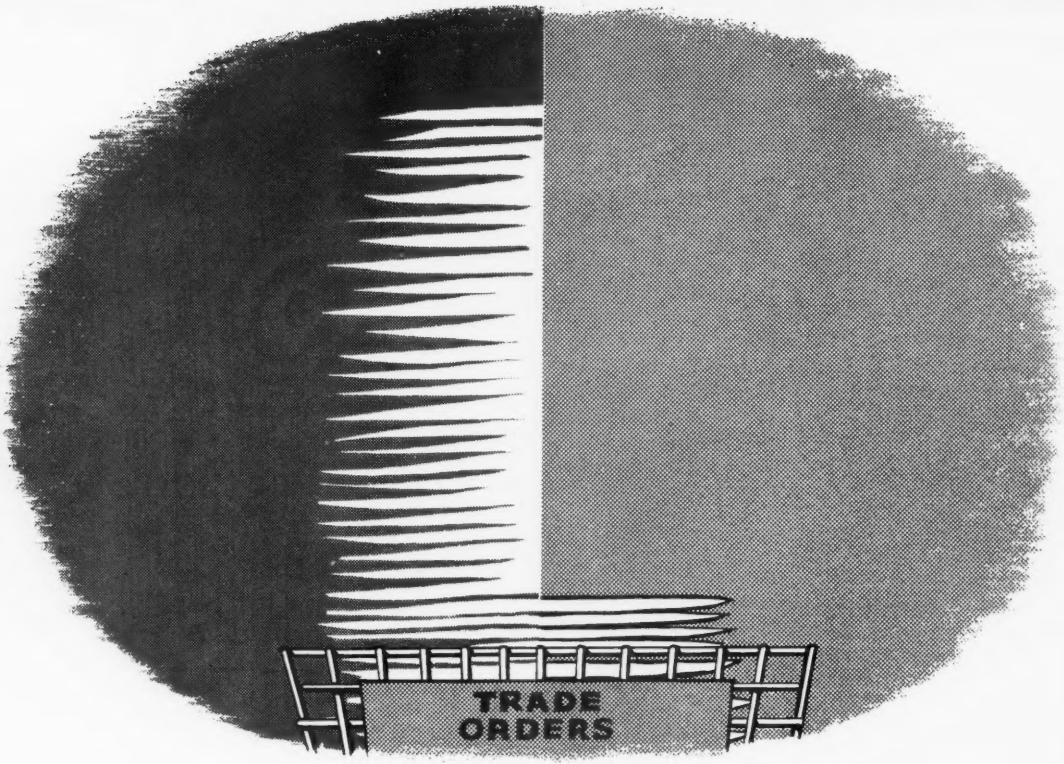

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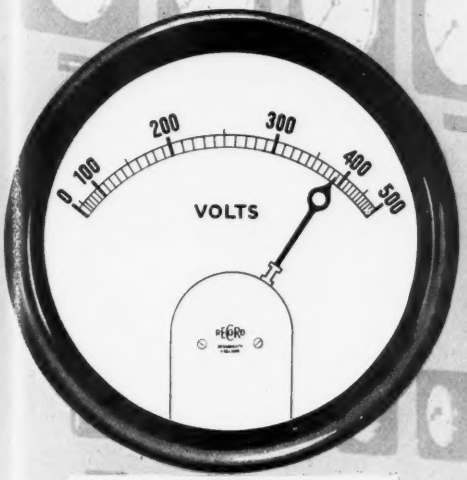

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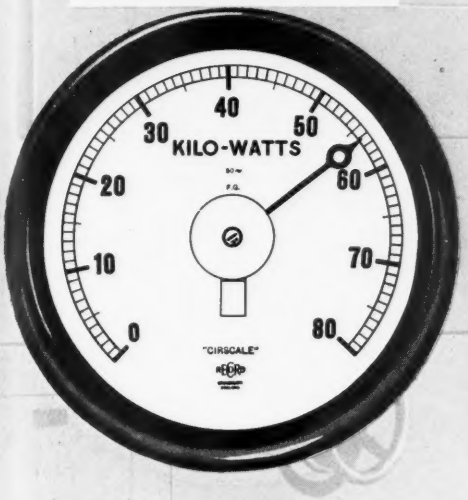

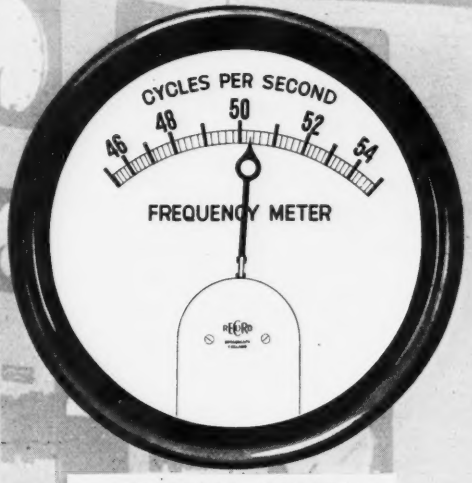

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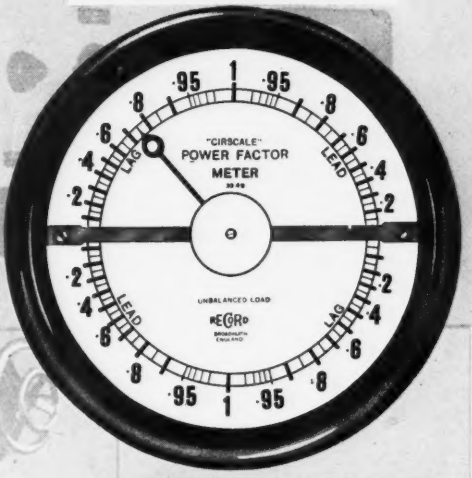

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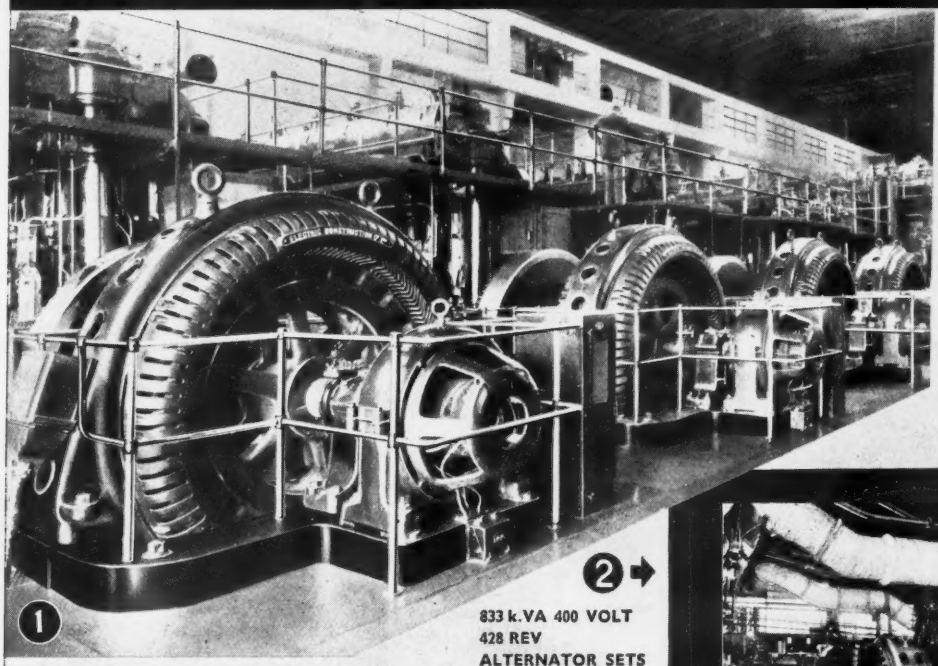

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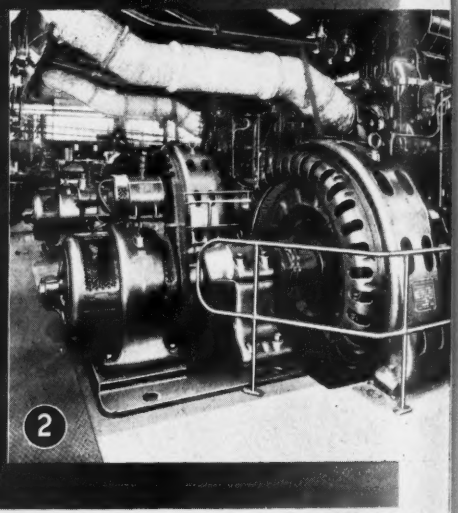

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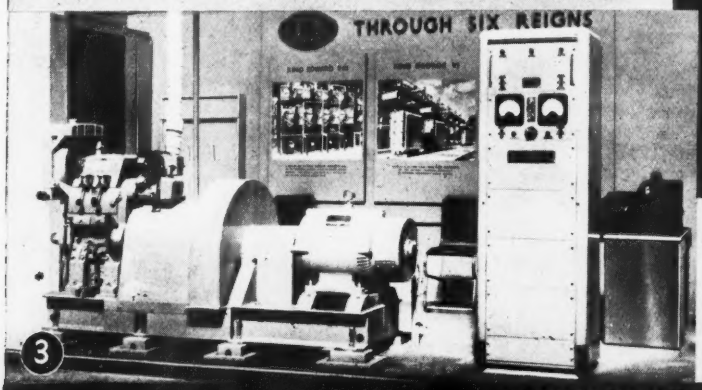

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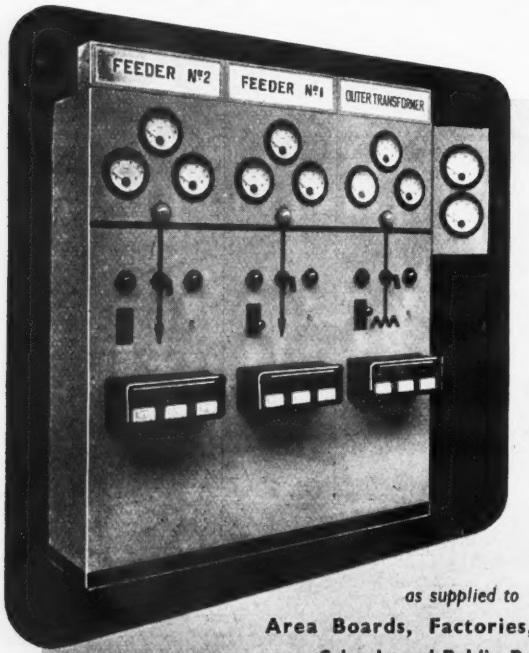

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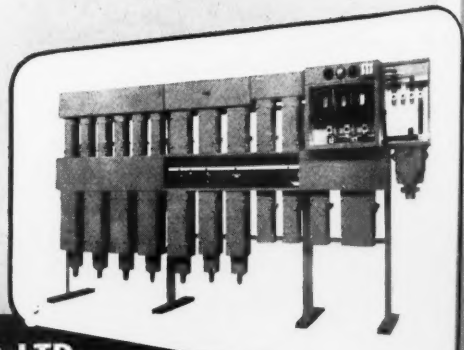

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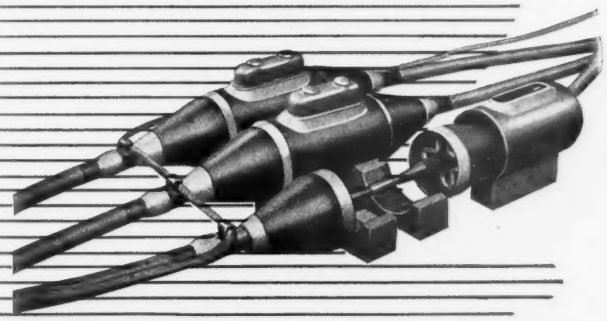

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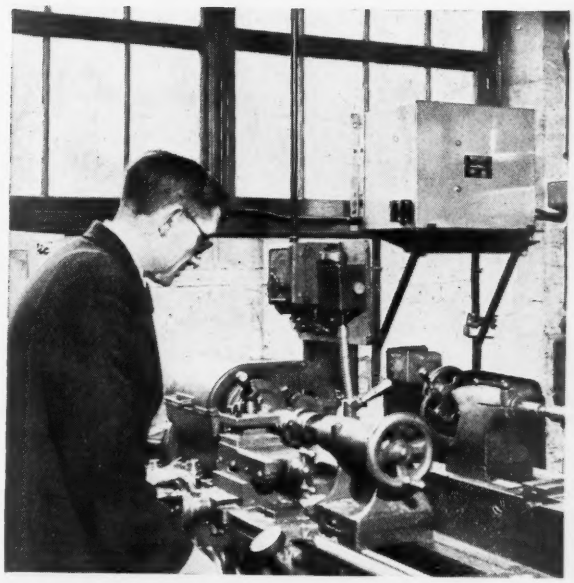

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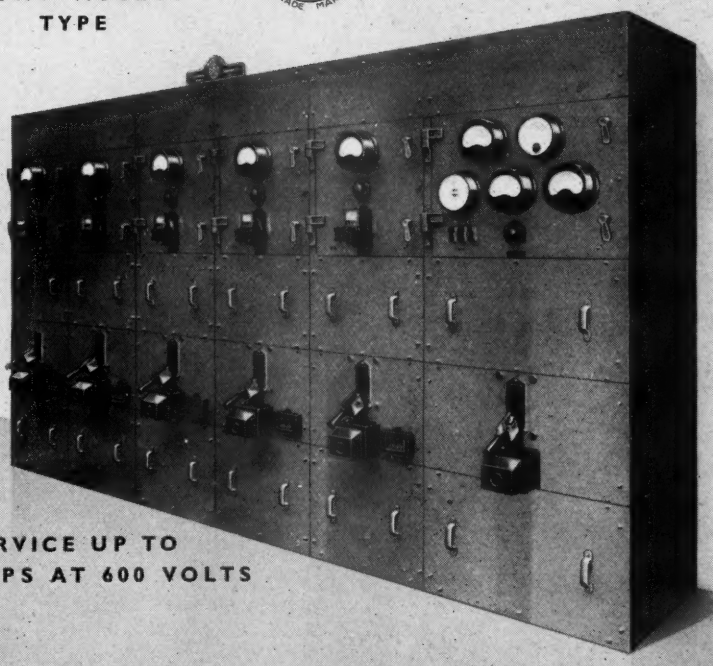

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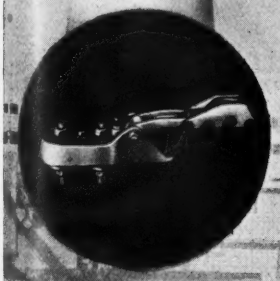

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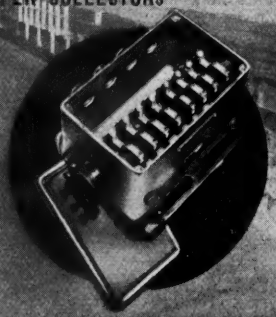

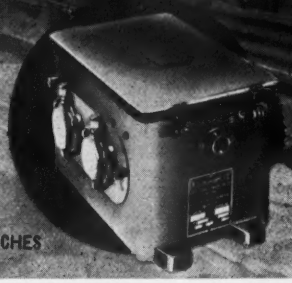

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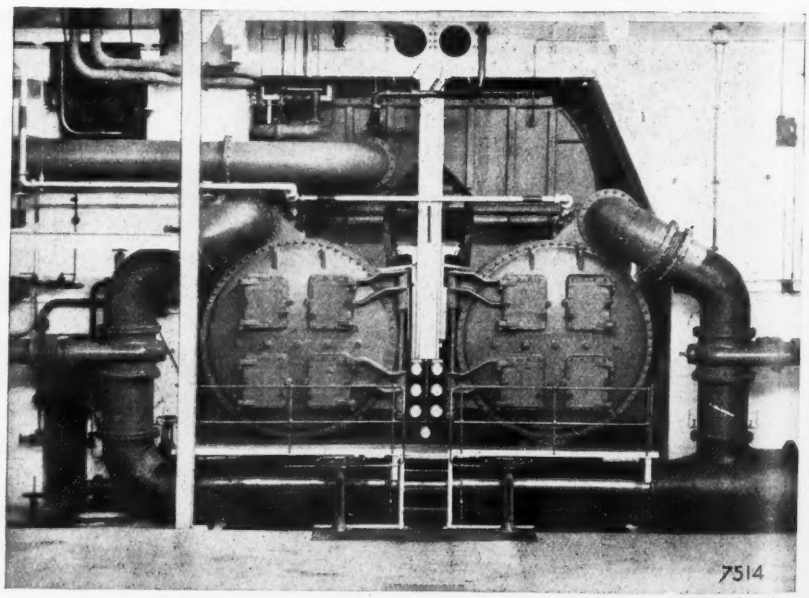

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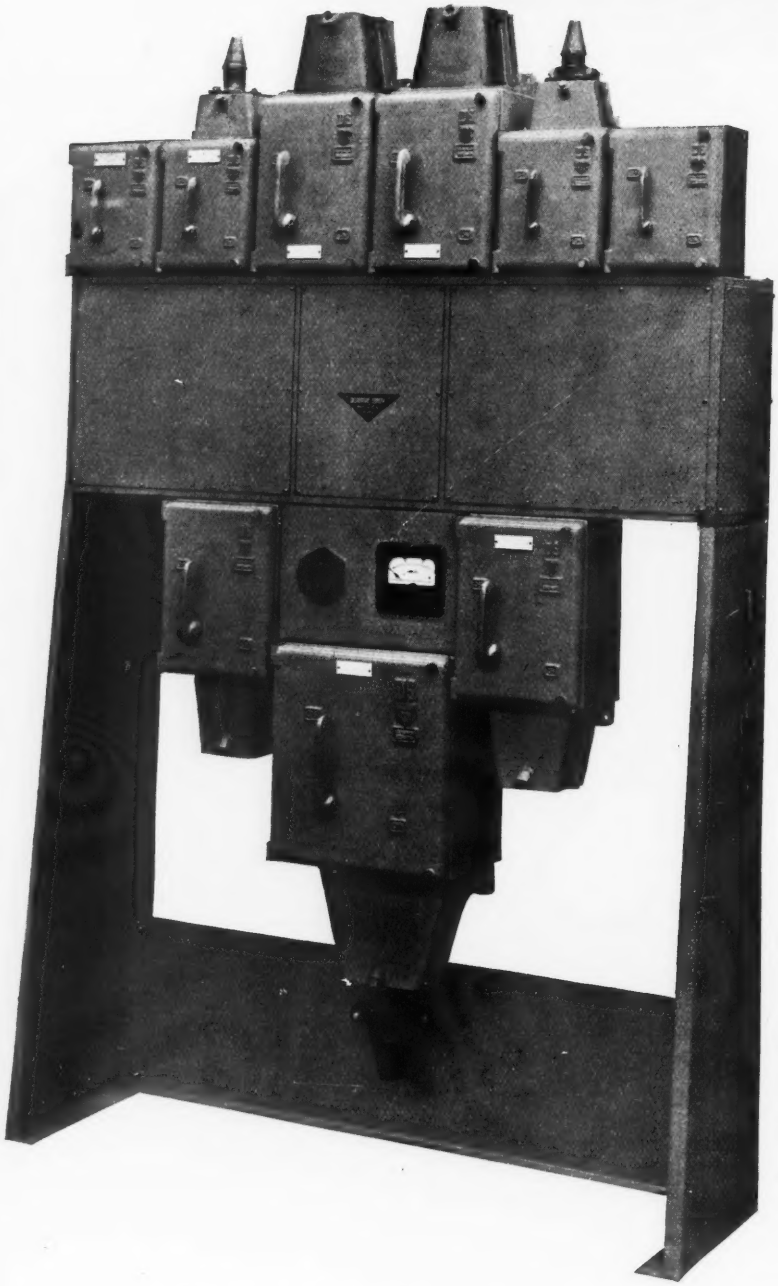

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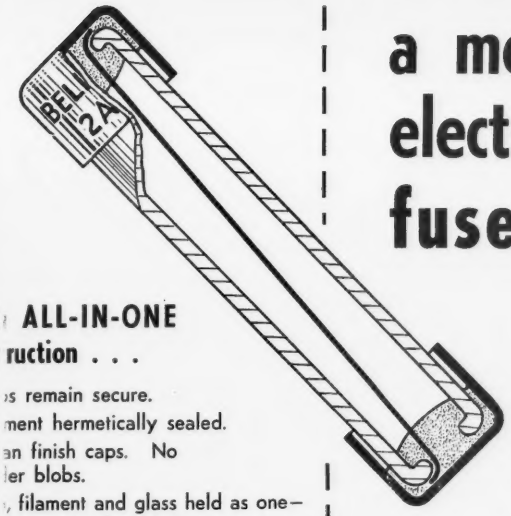

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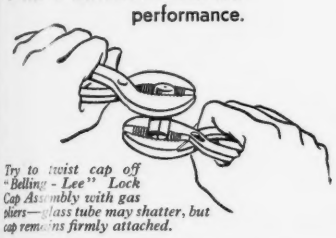

Try to twist cap off "Belling-Lee" Lock Cap Assembly with gas pliers—glass tube may shatter, but cap remains firmly attached.

The L.1055 is available in ratings from 60 mA to 25 A but at present this new construction applies only to ratings of 500 mA and over. It is hoped to include the lower ratings later, but in the meantime, industry will be supplied with our original design in which we have always minimised the problems that "all-in-one" construction obviates.

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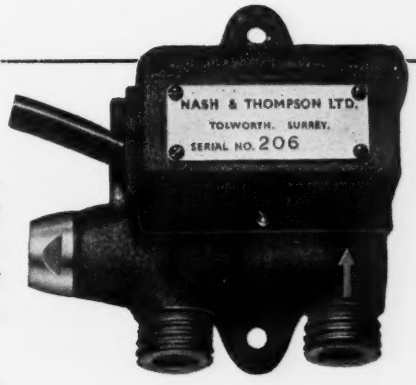

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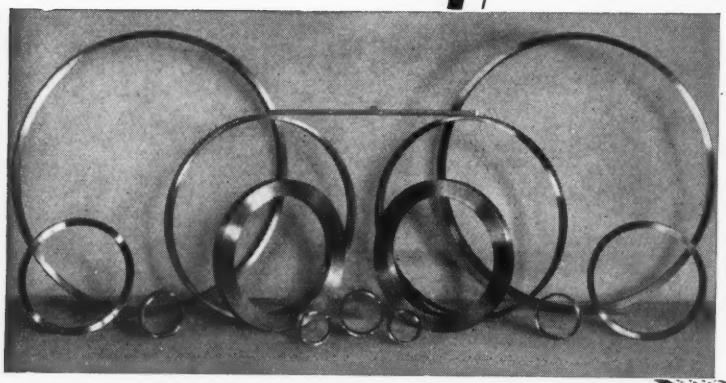

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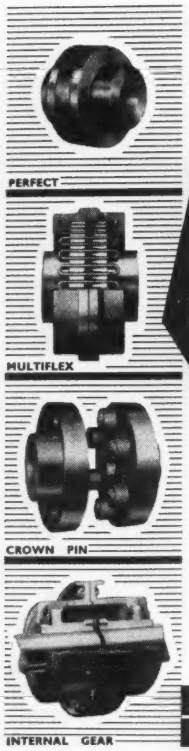

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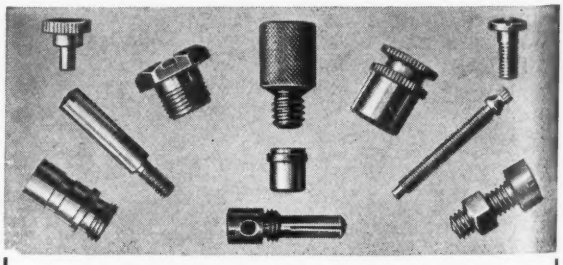

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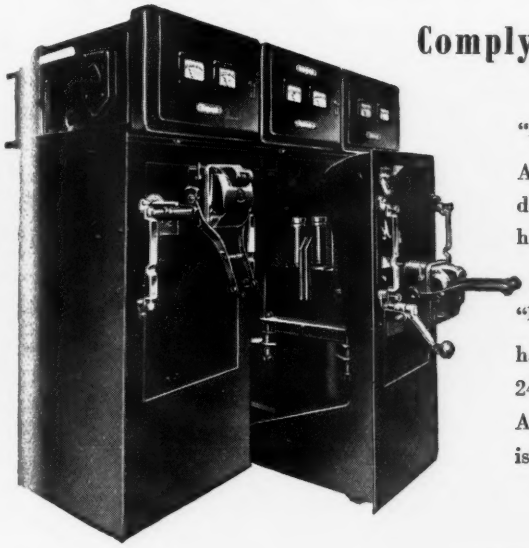

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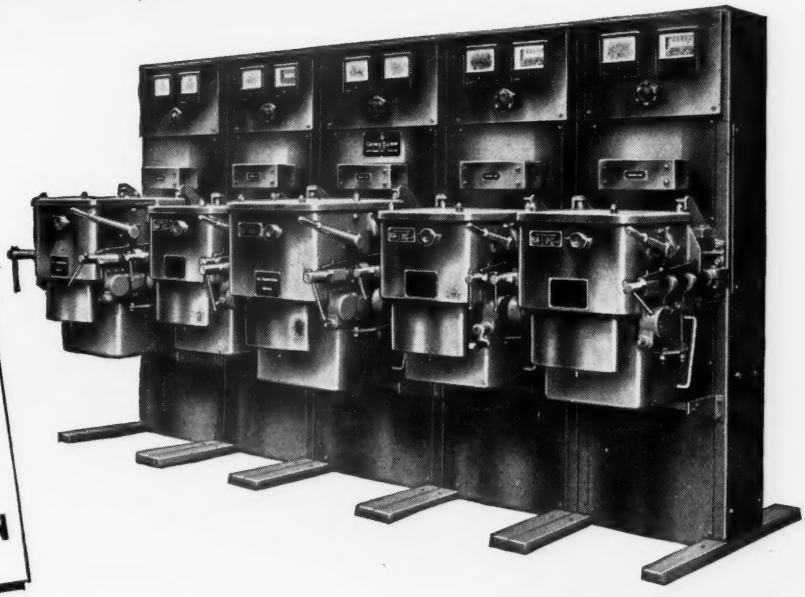

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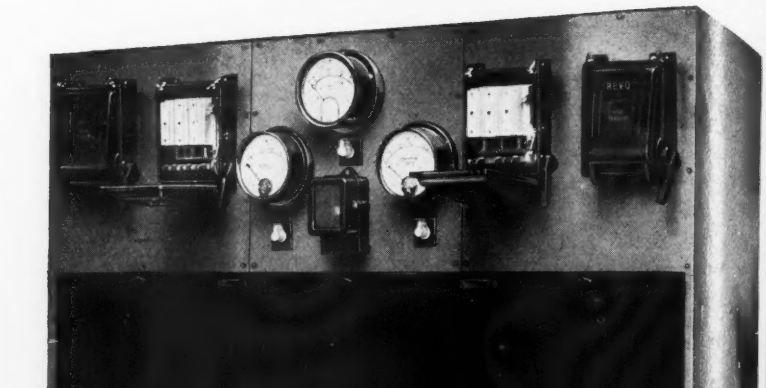

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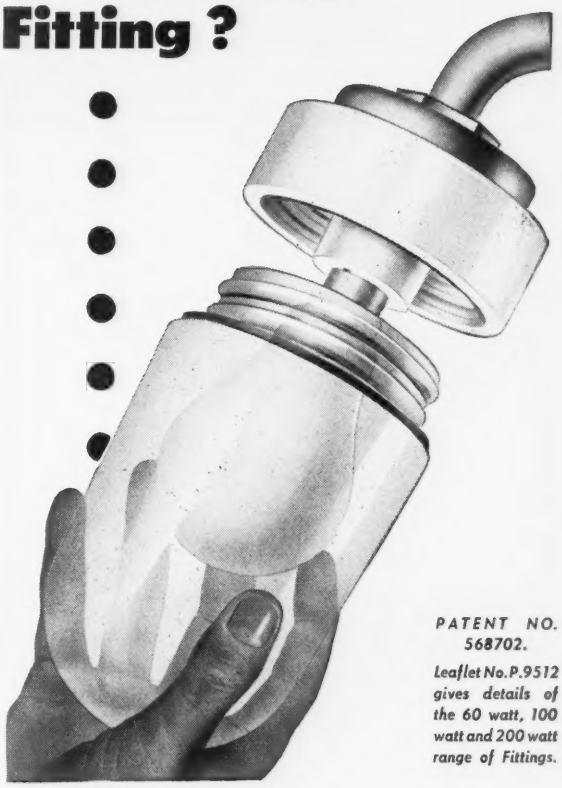

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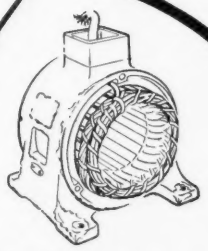
will reduce insulation breakdown



This silicone-insulated open end shield pump motor, subjected to thio-glycollic acid fumes and 50% overload, had a life of 4½ years. Previously Class 'A' motors lasted 1—3 months.

If you run motors or transformers that have to work in conditions not fit for a dog — or if (however kindheartedly) you demand more work than the plant was intended to give — you undoubtedly suffer from insulation breakdown. *Silicone insulation would cure many of your problems — giving you more output and less trouble.*

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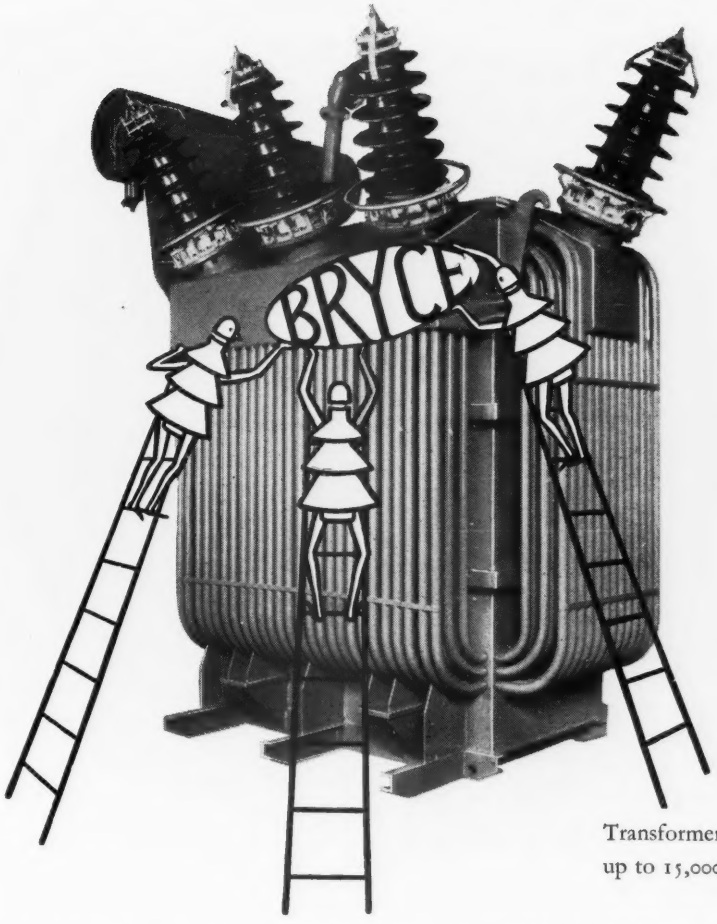

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This dependability is achieved by meticulous attention to detail from design to despatch.

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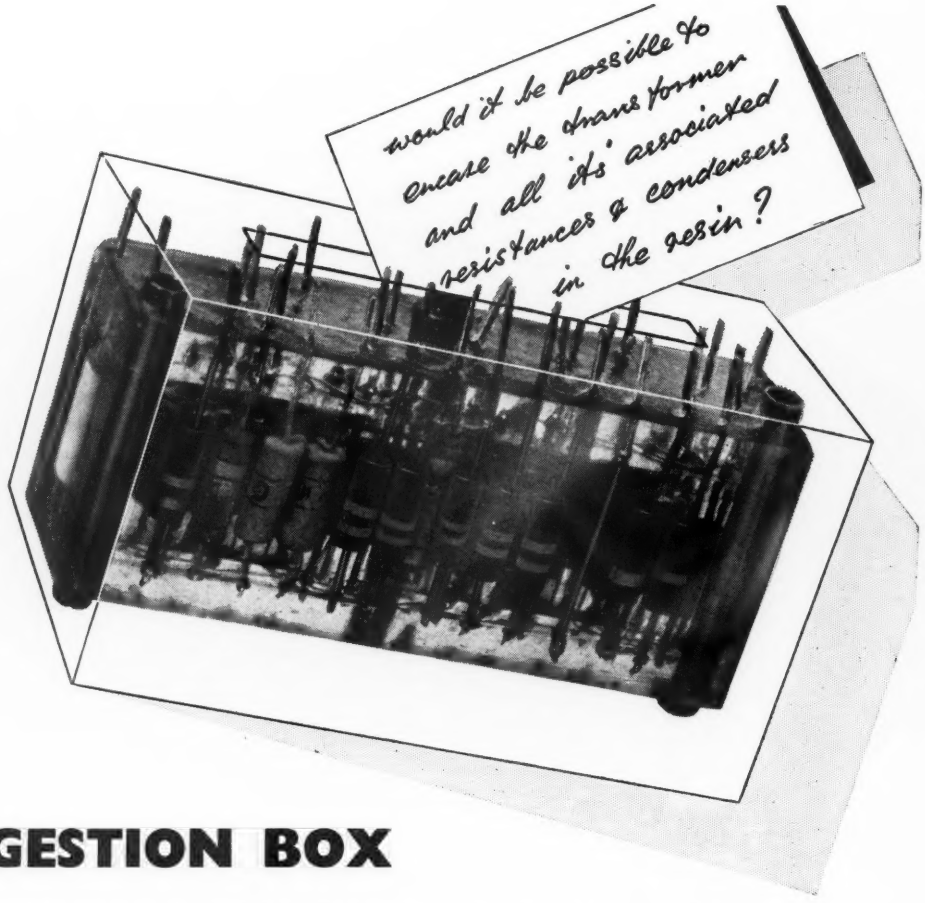

SUGGESTION BOX

Take a closer look at this! It may be full of suggestions for solving *your* problems. An intricate electronic circuit is embedded in BAKELITE Polyester Resin, SR.17449—the grade specially recommended for 'potting' circuits.

This resin has not only exceptionally high resistance to shock but it also protects delicate components from heat, humidity and corrosion. It is one of a group of BAKELITE Polyester Resins whose many different properties are being used in a wide range of applications.

It may be that this suggests ways in which Polyester Resins could be of service to you. If so, please 'phone or write to Bakelite Limited, who will be delighted to give you every assistance in following up new ideas.

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